

SEPTEMBER 1968

50 CENTS

Popular Science

MONTHLY

YOUR TV ANTENNA MAY BE OUT OF DATE!

See Special In-Depth Report
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A STEAM CAR IN YOUR FUTURE?

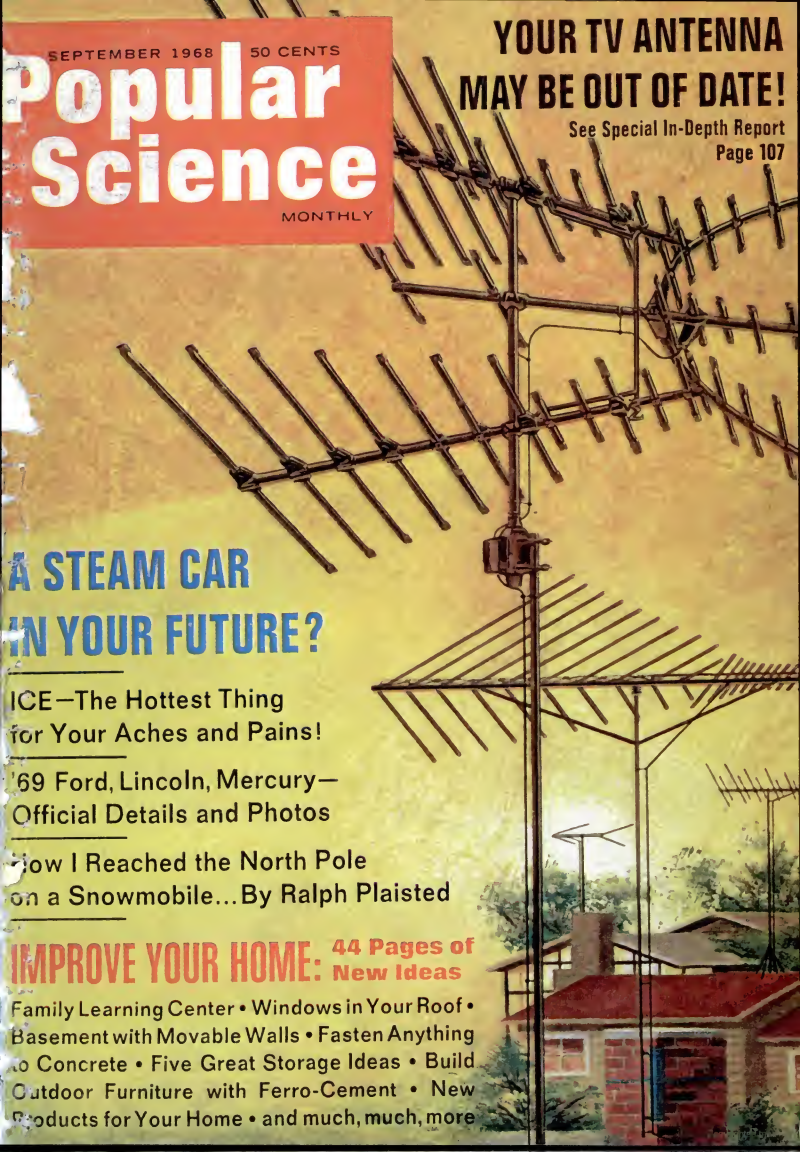
ICE—The Hottest Thing
for Your Aches and Pains!

'69 Ford, Lincoln, Mercury—
Official Details and Photos

How I Reached the North Pole
on a Snowmobile... By Ralph Plaisted

IMPROVE YOUR HOME: 44 Pages of
New Ideas

Family Learning Center • Windows in Your Roof •
Basement with Movable Walls • Fasten Anything
to Concrete • Five Great Storage Ideas • Build
Outdoor Furniture with Ferro-Cement • New
Products for Your Home • and much, much, more





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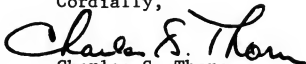
TOTAL READING TIME - ADULT MALES MEASURED BY SIMMONS

<u>Magazine</u>	<u>Hours Spent Per Adult Male Reader</u>	<u>Total Hours Spent Per Issue</u>	<u>4C Cost Per Thousand Hrs.</u>
POPULAR SCIENCE	2.9	10,776,400	\$.72
Popular Mechanics	2.0	9,062,000	.89
Mechanix Illustrated	2.1	8,135,400	.83
Outdoor Life	2.0	8,580,000	1.13
Field & Stream	1.8	7,608,600	1.21
Playboy	2.5	22,565,000	1.53
Esquire	1.4	5,804,400	2.25
Sports Illustrated	.6	3,298,200	4.89
True	1.8	7,534,800	2.10
Life	.7	11,932,900	4.89
Newsweek	.9	6,023,700	3.22
Time	.8	7,140,800	4.43

And that's not all. Popular Science readers do more than spend reading time. They spend money, too. 40.3% of our heads-of-households earn \$10,000 and over. More than 7 out of 10 own their own homes. Forty-four per cent own two or more cars. Our quality audience, consisting of eager and heavy users, also leads in buying of the products you sell.

So come on into the next issue of Popular Science -- the best-read, most efficient magazine you can buy. You couldn't make a better choice.

Cordially,

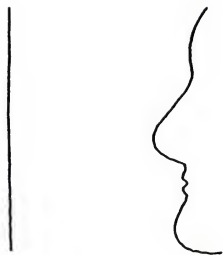


Charles S. Thorn
Executive Vice President
Advertising Sales

Source: Selective Markets and The Media Reaching Them.
- 1968 W.R. Simmons & Associates Research, Inc.

September, 1968

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A blade is straight. Your face isn't.

If you're like most men, you want a good, close shave.

And you think the best way to get it is with a blade.

So you try every new razor that comes out. You change your brand of blades. And you wonder why you still don't get the kind of shave you want.

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It's your face.

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The Norelco Tripleheader comes in a Cord model and a Rechargeable model.

And either one can make shaving a whole lot easier to face every morning.



Norelco®
you can't get any closer

HIGHLIGHTS OF THIS ISSUE:

To the North Pole on a Snowmobile BY RALPH PLAISTED PAGE 55

The leader of a gallant team tells how they rode to the top of the world on ski scooters.

Is There a Steam Car in Your Future? PAGE 64

Crazy? Maybe not. In just three years, you could be hissing down the road under steam.

Ford and Mercury Upgrade All Full-Size Cars for '69 PAGE 84

Official details and photos on the '69 Fords, Mercurys, and Lincolns.

Your TV Antenna May Be Out of Date! PAGE 107

Antenna not pulling its weight? Special in-depth report tells you what to do.

Fall Home-Improvement Section PAGE 138

Big 44-page section is loaded with ideas. For openers, how about windows in your roof?

COVER PAINTING BY HOWARD KOSLOW (Antennas shown: Winegard SC-1000, Finco CS-D3)

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COMING NEXT MONTH

If you're even dreaming of buying a new car, you'll want the big '69 auto section in October PS. You'll find all the new models pictured in full color, and described, *plus* the vital information you need to pick the right options for you, from the thousands of combinations available.

And speaking of cars, next month's PS Extra gives you the money-saving inside story on your auto battery—how it works (and why sometimes it doesn't), how to keep it at peak performance, which one to buy when you have to replace it. In the same issue:

- Do-Anything Bob Gannon Learns to Fly the Hard Way
- Nuisance Callers, Beware!
- Why Guns Kick and Rockets Fly
- Roundup of the Lively New Snowmobiles
- What's New in the '69 Outboards
- All About Wood Flooring
- Tilt-Top Table (with blueprint) and lots more.

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Do a little name-dropping the next time a fellow craftsman drops by.

He'll nose around your workbench, then say: "Aha—I see you use Nicholson files."

And you'll answer, very casually: "Doesn't everybody?"

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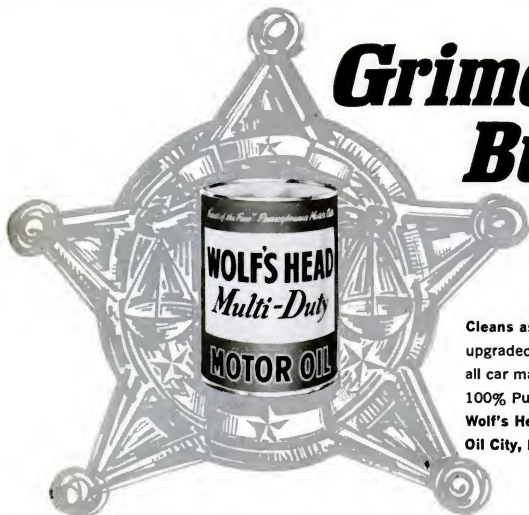
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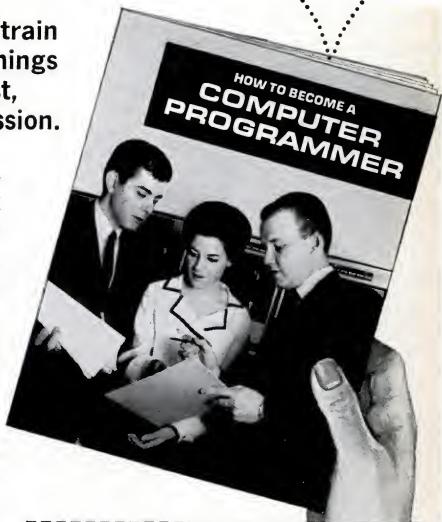
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PS Readers Talk Back

Gas-saving gadgets

Thanks for the information in "Test Report on Those Gas-Saving Gadgets" [July]. I have received many ads in the mail about these. Your article has stopped me from even thinking of buying any until I really look into it carefully.

ALLEN VAN BEMMEL, Castlewood, S. D.

... I don't see how you can say those gas-savers don't work. I have several of these devices installed and they really work. The



only trouble is that I have to stop every few blocks to drain the gasoline I make.

S. HURWITZ, Bayonne, N. J.

... Having been a PS fan for 30 years, I am prompted to express my thanks and admiration for what I consider an outstanding job. During an era when most products in this country have undergone what I call negative evolution—cheapening and degradation of workmanship—your leadership has been responsible for an improved PS. I am particularly impressed by such articles as the test report on the gas-saving gadgets. You certainly performed a real public service, in addition to reminding us that your loyalty to readers transcends financial subservience to advertisers.

C. W. FOWLER, Orlando, Fla.

World War I planes fly again

In "Wire-and-Fabric Wonders of World War I Fly Again" [July] you show a picture of a "1910 Bleriot monoplane." Actually this is a Demoiselle monoplane. It was invented by Alberto Santos-Dumont, the first man to fly in Europe. The story says that the plane could only get 20 feet off the ground. In Sept., 1909, Santos-Dumont flew the Demoiselle for five miles at an altitude of 180 feet.

EDWARD R. DONNELLY, Philadelphia.

A tip of the hat to all the airplane buffs who caught our error.

Record coast-to-coast auto run

In "Coast to Coast by Car in Under 45 Hours" [July] the map shows that Norbye and Dunne left New York at 11 a.m. and arrived at the Delaware bridge at 12:08 p.m. They say they took the N. J. Turnpike, which is 118 miles long and the legal speed (which they say they observed) is 60 m.p.h. How could Norbye and Dunne cover more than 118 miles at 60 m.p.h. in one hour and eight minutes?

JOE BETTI, Palisades Park, N. J.

Norbye and Dunne didn't take the Delaware Memorial Bridge, which is at the end of the turnpike. They took Exit 6 and the bridge over the Delaware River that leads to the Pennsylvania Turnpike, about half the 118 miles.

... I can't be convinced the Pontiac Catalina was capable of going 420 m.p.h. for a full 10 minutes. The distance between Indianapolis and Terre Haute, Ind., is approximately 70 miles. Your boys would have had to average 420 m.p.h. to cover the 70 miles in 10 minutes as shown on the trip map.

JOE FORMAN, Florissant, Mo.

They covered it in one hour and 10 minutes. They crossed a time zone, and, as noted under the map, the hour was given in local time for each city.

Surfing all wet?

Robert Gannon's article "Riding High in Search of the Perfect Wave" [July] brought back painful memories. Gannon's vivid description of the hardships suffered during

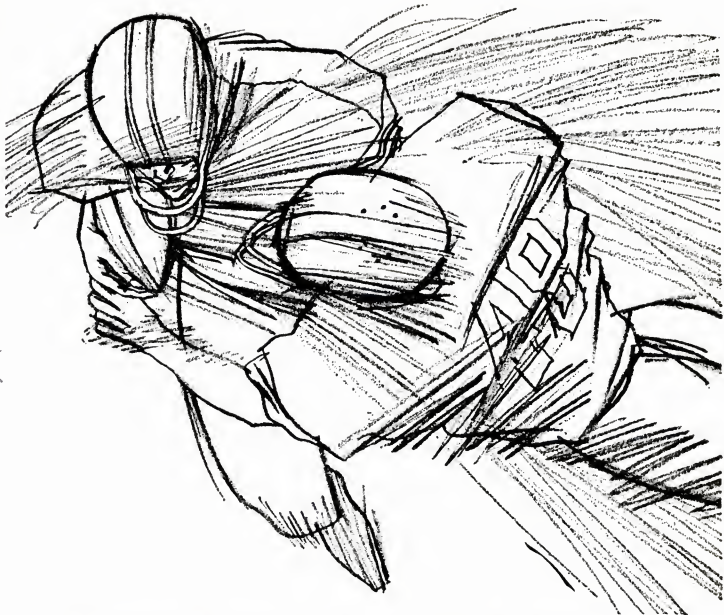


surfing lacks nothing—except the exhilarating thrill when you sell your board!

ALAN ANDREWS, Johnston, R. I.

... The article was a poor representation of surfing. You should have come to the West Coast for information on surfboard-building, because the East Coast is still in the Dark Ages. Boards now are seven feet, six inches long and 25 inches wide. Gannon must not have been near the ocean before. I have lived at the beach all my life and

Continued



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for the same reason it's in helmets:
*lightweight protection.***

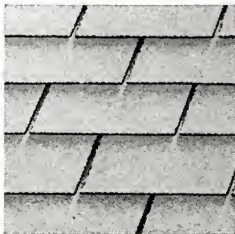
J-M's lightweight FGA® shingles give your roof special protection from weather, plus long roof life and low maintenance. Because fiber glass in shingles (as in helmets) resists cracking, curling, rotting and warping.

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If your roof needs replacing, do it with FGA shingles. They come in 14 wife-pleasing color blends. See them at your J-M dealer's.



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Give your 2 year old a DieHardTM

America's most powerful car battery makes a great present for your car.

If your car has reached its second birthday, its battery is facing its third winter and about half the batteries that come in new cars don't make it.

Even if yours does, it isn't the same old battery it once was. The old zip is gone. The starting power isn't there any more, as you may sadly discover the first really cold morning this winter.

And starting power is what a battery is all about. Enter DieHard: America's most powerful car battery. With a five-year Sears guarantee.

To put more power in a battery, you have to have some place to put it. So we got rid of the thick-walled old rubber battery case. Instead we

use polypropylene, a new, white, see-through plastic as rugged as it is handsome. And within these thinner but stronger walls we pack higher, wider plates and extra acid to match.

The result is 35% more usable starting power than the very best battery of its size anyone else makes.

And maybe 2, 3 or 4 times as much starting power as your old black rubber box ever had. Even when it was new. Such is progress.

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Contented Bond Street smokers tell us that on a single pipeful you can sail from Lake Forest, Ill. to Racine, Wis. (provided there's a stiff breeze behind you). And, if you pass other sailors along the way, one will surely say something complimentary about the aroma.

Lights easy—
takes its own good time
about burning.



PS Readers Talk Back

[Continued]

have never had my eyes stung by salt water, or had tooth fillings ground out by sand.

CHARLES WRIGHT, Manhattan Beach, Calif.

Two-by-twos add up to fine furniture

I was pleased to find the useful "lie-flat" blueprint with "A Roomful of 2x2s" [Apr.] and built the chair (below). I like its sim-



licity and sturdiness. You listed 4½-inch bolts for the chair's back support, but I found six inches was about right. I used an electric carving knife to cut the foam-rubber cushions to size.

JIM KIPP, Annawan, Ill.

Is there any difference in gas?

"Gas for Your Car" [June] quotes a Federal Trade Commission official as saying that "there is no difference in gasoline. They all come out of the same pipelines." He no doubt is of the opinion that mashed potatoes, boiled potatoes, and fried potatoes all come from the same pipeline also. Why do the majority of people permit such stupidity to reign?

HARRY G. WEBER, Hinsdale, Ill.

... In my area where I am a truck driver, one independent refinery sells, and I deliver to, no less than seven major-brand gasoline distributors and many private-brand outlets. A visit to a number of refineries will plainly reveal many major-brand tankers, along with common carriers, loading at the same platforms and taking on the same gas.

JOHN RUNFOLA, Fredonia, N. Y.

Maintaining trailer bearings

In your very fine article "Trailer Tips and Tactics for Boatmen" [July], you have overlooked one great error I see being made constantly—"dunking" trailers. Many trailers are equipped with so-called sealed bearings, and I have seen many that had to be replaced. Any bearing used in over-the-

Continued

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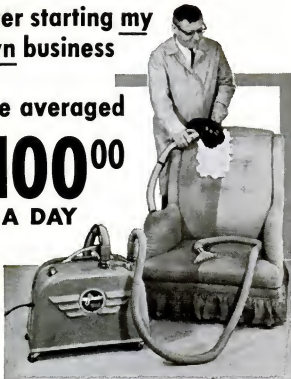
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PS Readers Talk Back

[Continued]

road service will tend to generate heat, if for no other reason than the internal friction of the grease. This causes an expansion and must be relieved through the seals. Drop this heated bearing in the water, and a vacuum is created within the bearing and a small amount is drawn into it. Result: corrosion. "Pack the bearing full of grease," I've heard some say, but in my years of experience I have seen many bearings fail due to overlubrication.

W. P. LILLER, Dunedin, Fla.

Builds a PS boat project

In January PS you had an article "Two for Your Outboard." I built an electric motor based on one of the ideas (see photo). I fashioned a three-piece aluminum housing for the motor and made an adjustable motor mount. I also installed a three-speed heater switch. Pieces of pipe and scrap metal were welded together for the rest of the parts. The unit swivels 360 degrees for reverse. It will push a 14-foot john-boat with two aboard in high-speed position.



JERRY UEBELHOR, Ireland, Ind.

Tip on mower care

In "Care and Repair of Your Power Mower" [July] you say when flooding occurs to remove spark plug and crank until no vapor comes out. I've found this unnecessary. I open the throttle fully along with the choke, and crank the engine. This forces vapor out the exhaust, and after a few tries the engine starts.

CARL LAMMONS, Dallas, Tex.

Thinks PS is the greatest

Your July issue is a classic. The stories on World War I airplanes, use of a metal finder, care and repair of lawn mowers, and the report on gas-saving gadgets make it one.

PAUL CLARKE, Denver, Colo.

Want to get something off your chest?

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"Say, Smokey—"

A clinic on cars by America's most famous mechanic

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Ask Smokey. You'll find the address at the end of the column. Please print your name and address.



.....

"The 390 engine in my 1967 T-bird started out by using a quart of oil every 200 miles. Two intake-manifold gasket jobs didn't help. A ring job at 8,000 miles helped, but only for a couple of thousand miles. Another intake-manifold gasket with valve guides didn't help, and started making the engine miss when cold—though after it warms, it smooths out. Have just had a tune-up with new plugs, etc., with no help and am desperate. The dealer is willing, but doesn't know what else to do."

P. C. REASONS, Eudora, Ark.

How come so many intake-manifold gaskets? I'd be suspicious about a bad fit, or even a bad manifold. The high oil consumption is not normal, or in any way characteristic of that engine. The engine either was not put together right, or it contains some defective parts. If the dealer is on the level about being willing to make this right, then have him tear the engine completely down, from top to bottom, examining all parts as he goes. Since it could be a leak, high crankcase pressure, a bad piston-ring seal, or even parts machined out of tolerance, it might be better to write Ford, and dump it in their lap.

"Please explain the difference between 'hot' and 'cold' spark plugs, and when each should be used."

LOUIE E. ENTZ, Monte Vista, Colo.

Hot plugs are for the sissy-type engines that don't develop high combustion temperature, or power. Basically, the cooler the plug, the more heat it can stand. But you're more apt to have problems with fouling. It's best to stick to manufacturer's recommenda-

tions, taking into consideration your driving habits and local conditions. If you change brands, make sure you get the proper heat-range plugs or you may wind up with an education in major engine surgery.

"I'm considering installing a capacitor-discharge ignition system in a six-cylinder 1967 Mustang. Should it improve my gas mileage? Could it be at all detrimental to the engine? Would it void the manufacturer's guarantee?"

HOWARD I. GREENBERG, Norman, Okla.

With no other changes, don't look for any mileage increase. Your car will start better, and it won't hurt your engine—in fact, will be in its favor. Yes, it will technically void the warranty. If you ask if it's worth spending money on, I'd say No!

"When I pull the dipstick to check the oil level on my '62 car, there is a pasty yellow substance on it that looks like mayonnaise. If I let the engine idle in the garage, this stuff drips out of the road draft tube. I use the best 10W-30 oil, have a new filter, and use a motor desludger at each oil change."

JOSEPH OAKS, St. Louis, Mo.

It sounds as if your mayonnaise stems from a leak that allows cooling water into the oil system.

"My 1964 Skylark with 300-cu.-in. engine and two-speed automatic transmission runs very well, except when I kick down to get into passing gear. At 60 m.p.h. the engine sounds like it is running full; then it slows slightly; then runs full speed; and continues on and off, on and off until you let it fall be-

Continued



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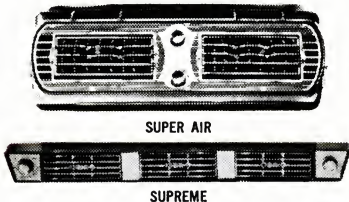
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Address.....

City..... State..... Zip.....

My car is a.....(year).....(model)

Engine displacement.....Horsepower.....

Power Steering.....yes.....no

Floor shift.....Steering column shift.....

Smog pump.....yes.....no

*plus state tax where applicable

"Say, Smokey—"

[Continued]

low 60. Would this be caused by a sticky throttle, or a transmission going bad?"

DAVE PEW JR., Pittsburgh, Pa.

You'd better head for the nearest transmission shop. It sounds from here like a sludged-up valve body.

"At 60,000 miles, smoke fumes were coming out of the oil-filter tube in my car when the engine was hot, so I had new rings and a valve job. A hundred miles later, it was still smoking a little. The mechanic says I should drive it up to 1,000 miles, then bring it in, and he will adjust valves and carburetor. He wasn't upset about the smoking, and tells me that the rings will seat themselves. Is this truth or fiction?"

MRS. GEORGE PETERSEN, St. Louis, Mo.

The mechanic is right. It does take the rings some time to seat in. Cars with high mileage don't have real straight cylinder walls and require more time for the rings and wall to "get acquainted."

"My 1967 Rebel has a tendency to weave in a crosswind, and to lean to the side where a heavy person rides. The dealer has been of no help. Would load levelers help, or butyl-rubber air lifts?"

EDGAR F. AHALT, Hyattsville, Md.

A car that weaves in crosswinds is dangerous. I don't have room here to tell you all the things that would have to be done to fix it, but I can point out some of the causes: Biggest reason is in design—that is, incorrect suspension geometry, causing a front or rear steering effect when the car rolls or as the wheels travel up or down. Tires that are weak laterally can also be the cause. Anyway, heavier springs and shocks would only be lipstick for this problem.

"My MGA veers right when I back off the accelerator in normal street or highway driving. When I speed up, it pulls back to the left. The car has been hit in the front but shows good repair work and no chassis damage. How can I correct this steering problem?"

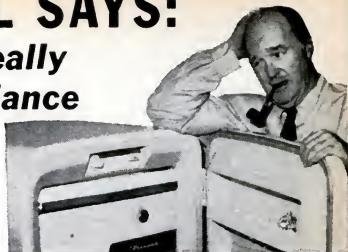
CHUCK GRIMSLEY, Compton, Calif.

You are driving a dangerous critter. Either the rear axle is bent to the left or it's floating in its mountings. Another possibility is that the frame was knocked out of shape in that collision. Have the whole chassis checked and repaired before you wind up wearing it.

Continued

TOM McCaHILL SAYS:

"A Smart Guy Can Really Clean Up in the Appliance Repair Field"



Those electrical gadgets you have around your house are great on convenience, but if you're like a lot of do-it-tomorrow Johnnies, you don't know where to turn when one breaks down. So you call one of the busy Appliance Servicemen in your town, then drink instant until that fancy automatic coffee pot is perking again.

People have so many electrical appliances, it's no wonder Appliance Repairmen are busy as a bear in a bee nest. Count yours. The average home has at least a dozen, maybe more. There are better than 800 million appliances in the U.S.A. right now. No wonder the man who knows how to service appliances properly is pocketing \$4 to \$6 an hour, for as many hours as he cares to work!

If you're interested in making money (and who isn't), here is a job field crying for good men. And it's no sweat at all to get the training you need. Thousands have trained with National Radio Institute's Appliance Division. NRI has a great, low-cost home-study program covering every type of Appliance repair in detail. You study at home, in your spare time, learning through actual practice how to fix home, commercial and farm appliances. And not just the little stuff, either. Besides cantankerous coffee pots and toasters, you can learn how to repair air conditioners, refrigeration equipment, even small gasoline engines—and that's where the big bucks are, in the major appliances you'll fix.

NRI is one of the biggest and best schools in the home-study field. They have this Appliance Servicing course worked out to the most nit-picking detail. Yet, you'll be amazed at how little it costs. You even get a 25-buck professional Appliance Tester without extra cost. With your Tester and a few basic tools you probably have in your house, you'll be doing repair work long before you finish the course. And you can work anywhere—

in a corner of your basement, in the garage, even on the kitchen table.

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There's nothing to lose except a postage stamp and the energy it takes to walk to the mailbox. What you'll get for your efforts is the newest NRI Appliance Servicing catalog. Nobody is going to ring your doorbell to pressure you into signing an enrollment blank. NRI doesn't employ salesmen.

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Tom McCaHill

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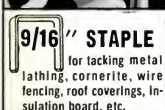
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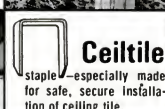
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"Say, Smokey—"

[Continued]

"When I accelerate hard, my 1967 Chevy 325-hp. V-8 has a flat spot with a one-second count before it picks up. This happens at any speed. The dealer says it is normal. I say it is a safety hazard. Any advice?"

ROBERT KRIEGER, Chicago, Ill.

You have carburetor trouble. It's too lean on acceleration, and possibly there is not quite enough spark advance. A good dealer could fix it without any alibis, since he is supposed to have the parts and information. But I think I ought to warn you that it will take a good carb man to fix this right since I feel it starts from a carburetor-design problem on that model.

"I have had repeated valve burning on my 1960 overhead-valve Rambler six. They also tighten up after 3,000-4,000 miles. What causes this? Is there any way I can convert to rotating valves?"

DEAN W. MUMAW, Huachuca City, Ariz.

Get high-buck valves for this engine. Rotators are better, but not necessary. Check out your exhaust system thoroughly. Also recheck the timing, and carburetor jetting and settings.

"I have heard that sustained high speeds are harmful to an engine, so what is considered high speed? How much should that speed be varied and for how long at each speed? How often should oil be changed during extended driving—particularly when pulling a trailer?"

LAUREN COLEMAN, Vestal, N.Y.

Most engines today are capable of sustaining legal speed limits without being considered abused. Or they can be run at quite high speeds, assuming the proper gear ratio and tire size are in the package. Since engines vary widely in their capacities, I'd have to give you the maximum normal speed—4,500 r.p.m. If a car gets a trip of 100 miles or more several times a year, you shouldn't have to do any planned speed driving for proper engine maintenance. You've given me so many variables on what you expect of your car, and so little information about it, I can only say, as to the oil changes, that the more she has, the longer she'll last. And don't forget the filter changes.

Got a question on autos? Send it to:

"Say, Smokey—" POPULAR SCIENCE
355 Lexington Ave., New York, N.Y. 10017.
Not every question may be used. Questions cannot be answered by individual letters.



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- ✓ Car manufacturers' dwell angle recommendations are included in the manual provided with the Model BT-162 for all cars including the external adjustment type distributors specified above.
- ✓ It is no longer necessary to file points to smoothness when using the Model BT-162. The instrument will automatically make allowance for any existing "pitting" or "wear."
- ✓ To adjust for mathematically correct carburetor adjustment and thus insure maximum gas economy and

quiet engine running, simply use the Tachometer section of the Model BT-162. Read the exact RPM while the engine is in neutral position. Then adjust the carburetor in conformity with the car manufacturer's recommendations as specified in the manual provided with the Model BT-162.

- ✓ To locate a "miss" you need only disconnect or "short" the spark plugs one at a time with the Model BT-162 switched to the Tachometer position. You will be able to instantly identify which particular plug (or frequently its wire lead) is responsible for the malfunction.
- ✓ Cars with automatic transmissions function efficiently only if the fluid pressures are correctly maintained and since manufacturer's instructions always refer to RPM the Model BT-162 (or an equivalent tachometer) is required to properly service automatic transmissions. Incidentally, the 5,000 RPM maximum range of the Model BT-162 is adequate for all car engines without any exceptions.

The Model BT-162 comes complete, ready to use. Tune-up and operating procedure manual included with your Model BT-162 describes in detail how to make all tests. Also includes manufacturer's dwell angle recommendations for all cars, American and foreign. Packed with information from cover to cover. The manual is yours to keep even if you decide to return the instrument.

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Science Newsfront

Last-minute news
and notes to keep you
up-to-date

By W. STEVENSON BACON

New jet belt with miniature turbojet engine can carry a man for miles, letting him fly forward, backward, sideways, turn, or hover at standstill. Bell Aero-systems' successor to the famous rocket belt, the jet belt is now undergoing preliminary testing. The two thrust nozzles are manipulated with hand and arm motions to control flight. Part of the intake air is deflected around the engine and mixed with the output to keep heat from reaching the pilot or fuel—kerosene in clear-plastic tanks.

A stoplight that "listens" to traffic could take a lot of the pain out of city driving. Developed by Matsushita of Japan, the new traffic controller incorporates a microphone in a horn aimed down the road. When the noise level is high—due to a steady flow of traffic—the light remains green for longer periods. A reduced noise level returns the stoplight to normal timing between red and green signals. Simple in design, the "listening stoplight" could be produced for about the same price as an ordinary light—and for far less than the cost of installing a computerized traffic-control system.

Tall buildings that "get the shakes" are giving engineers real trouble. Skyscrapers, TV towers, bridges, and other structures have a natural frequency at which they oscillate. At exactly the right wind speed, they swing violently and may collapse. (The Tacoma bridge, which fell in a 40-m.p.h. wind, was an example.) Old buildings were made of masonry and had weight-bearing partitions that dampened the oscillations. Modern buildings do not. Working on the problem are researchers headed by Dr. Gerrit H. Toebe of Purdue. The tools: water tunnels in which flowing water sets up vibrations in cylinders representing tall structures. The objective is to avoid expensive repair jobs—like those on the oscillating Saturn V tower (slight change in shape) and a new Czech bridge (dumping tons of gravel into steel columns for damping).



Flat, hang-on-the-wall TV sets no more than three inches thick are a good possibility with a new, ultrathin picture tube. In an ordinary TV tube, electrons from the electron gun many inches behind the screen are accelerated against it to cause the phosphor to glow. The new picture tube places the electron gun at the top of the tube, accelerating the electrons down against a reversing lens at the bottom. The lens folds the beam back on itself through 180 degrees, bouncing it up onto the screen. Inventor of the tube, which may be used in sets by the early 1970s, is Prof. Dennis Gabor of Imperial College, London. He also invented holography.

Far-out wheel-less trains that travel on rollers and hurl passengers from city to city at speeds close to that of sound are being designed in Japan. Powered by four rocket engines giving over 8,000 pounds' thrust, the trains will be 720 feet long and 18 feet wide, and will seat 1,000 passengers. They'll flick along on rollers mounted in large square frames, resembling hurdles. To add impetus, the rollers will revolve 70 times a second. The trains, called sonic-gliding expresses by the inventor, Dr. Hisanojo Ozawa of Meijo University, will cut travel time between

Continued

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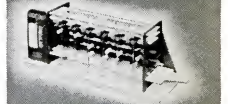
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Science Newsfront

[Continued]

Tokyo and Osaka (320 miles apart) to a mere 35 minutes. A model of the sonic express recently hit 575 m.p.h. and a larger prototype will soon aim for 730 m.p.h.

Barnacle cement, the strongest glue known, may be put to work holding the fillings in your teeth. It could also be used as an instant repair for broken bones. Long the blight of boat owners, barnacles stick to anything except copper—and with such tenacity they often have to be chiseled away. The cement excreted by the creatures cures in contact with moisture, and cannot be dissolved in strong acids or bases. In a program sponsored by the National Institute of Dental Research and conducted by the B. F. Goodrich Co. and the University of Akron, scientists are trying to analyze barnacle cement and synthesize it. The adhesive would make dental work faster and less painful, since much drilling of teeth is now necessary to lock the fillings into place.

Talking 3-D picture books on microfilm which you "read" through fiber-optic "pipes" may one day make printed matter as easy to absorb as TV. Each page of a "cinebook" consists of rows of tiny 1½-by-2½mm film frames in color or black and white. To "read" a page, a fiber-optic stylus is moved along a miniature guide rail. The 3-D images are transmitted to the eyes through a branched bundle of glass fibers that looks like a stethoscope. The fibers end inside a pair of dark glasses. Because the picture is so close to the eye, it appears full-size. Cine-books were developed by British inventor George Davies, who plans to add a sound track.

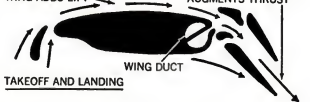
Jet airports right in the heart of the city would be practical if a new STOL (Short Take-Off and Landing) jet plane becomes

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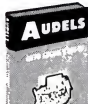
practical. The planes will be able to take off in just 1,500 feet and land at safe, slow speeds. The secret is the unique augmentor-wing shown in the drawing. A blast of air

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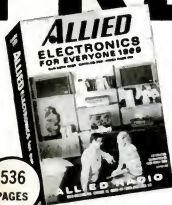
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Science Newsfront

[Continued]

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Gamblers at the Four Queens Casino in Las Vegas are playing a new type of roulette. The big attraction: If you play well, you have an exactly even chance of winning. There's no percentage for the house. One condition: A PDP-7 computer looks over your shoulder, records results, and calculates how well you judge the odds. Purpose of this lively game, called "Stakes and Odds," is to study risky decision-making. The idea is that every human decision depends on judgments of stakes (values won or lost) and odds (probabilities of each possible outcome). Investigators from the University of Michigan and the Oregon Research Institute are involved in the study, which applies to everything from buying a house to passing a car on the hill. Of course you use your own money—in the interests of reality! **E9**



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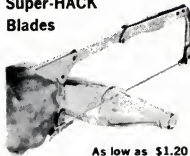
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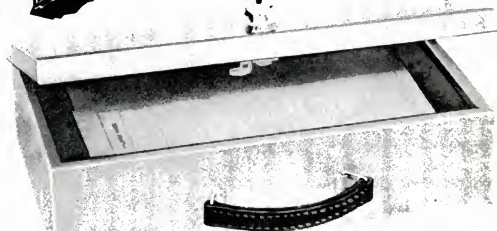
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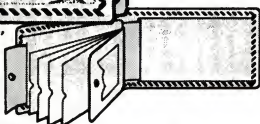
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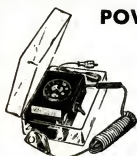
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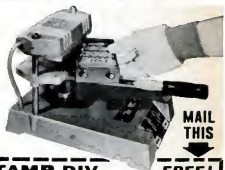
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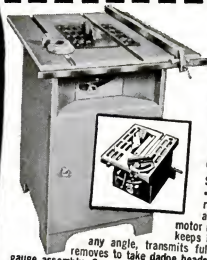
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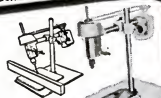
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Detroit Report...

DODGE'S J-CAR WILL BE NAMED CHALLENGER when it's introduced next fall. This is a sporty compact using the Dart's running gear, but with its own distinctive body. The Challenger name was used once before by Hudson for one of the last Essex models in the early Thirties. Dodge now has the name "locked up" and plans to stick with it, barring any last-minute changes. The Challenger will share a number of body and chassis components with the all-new '70 Barracuda.

Lincoln will drop unit construction for the '70 Continental. The car will be only moderately altered in appearance, but it will be radically different under the skin. Lincoln engineers plan to pare at least 250 pounds from the overall weight. Ford's S frame with its controlled-crush-rate front end, stretched to give a 126-inch wheelbase, will be used. The '70 Lincoln will have three inches more front overhang, giving the car a longer hood line.

Steam-powered Oldsmobiles are on the way! General Motors is donating five Delmont 88s to the State of California for steam-engine research [see page 64]. The state will remove the V-8s, install steam engines, and put the cars in use with the Highway Patrol. GM's part in the project ends with delivery of the cars. After a full investigation of steam power for present-day automobiles, California will make the test report public.

Ford's '70 Thunderbird will be radically restyled with a spade-like front end that resembles the snout on Indy racers. The hood continues well out forward of the front wheels and ends with a wide, slit-like air intake. To get cool air for the engine, two functional air scoops are cut in the top of the snout. In addition, Ford plans to reduce T-bird overall dimensions by building it on the Torino chassis (the Torino/Fairlane line will then drop unit construction and go to separate frame and body).

A breakthrough in air conditioning, expected within two years, will solve a whole passel of headaches. GM's Frigidaire Division is now working on a new air-conditioning system that eliminates compressor, belts, pulleys, and separate condenser. The heart of the new system is a piston-type pump that works off the automatic-transmission torque converter. An enlarged engine radiator is used to cool the freon with water instead of air. Additional benefits: shorter coolant hoses,

less engine-compartment crowding, lighter front end.

Import cars outsell U.S. compacts, according to 1968 statistics. While Detroit readies its '69 models, auto makers abroad are also preparing new cars. France's Peugeot, not in the top 10, is planning a comeback with a clean-styled 504 sedan, a four-cylinder 100-m.p.h. car. Italy's Fiat will soon show its six-cylinder Type 130, a deluxe compact to sell at around \$4,000. Germany's BMW will go after Mercedes customers with two smart-looking six-cylinder models called 2500 and 2800. To top them all, Citroën is expected to bring out a Maserati-powered supercar. Volvo is working on a six-cylinder engine for the 144 chassis, but it probably won't be ready until next year. Renault will begin producing its R6 next month—a subcompact front-wheel-drive economy car. There are rumors that Fiat is also planning a front-wheel-drive small car to supplement its rear-engined models. NSU will shortly announce an 1100 economy sedan with an OHC piston engine (it may get a Wankel later).

Antiskid brakes will become standard—given time, say GM and Chrysler executives. Auto makers are wary of experiments in brake systems. After announcing last summer that antiskid would go on the '69 T-bird, Ford backed down. Many supplier firms are hard at work developing two- and four-wheel systems, but the industry will not fit anything as standard until thoroughly proved. A recent demonstration at the GM Proving Grounds showed that, with a rear-wheel system, the driver retains no directional control, while a four-wheel system proved as good, or better than, the most skilled driver.



Detroit Editor



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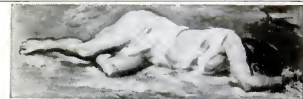
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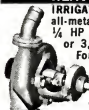
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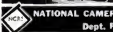
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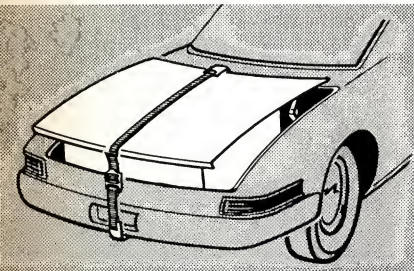


BELL & HOWELL SCHOOLS



High-pitched horn gives theft warning

The "alarm-tone" horn at the left sounds off with a piercing note if anyone attempts illegal entry into the car. Developed by Delco-Remy, it has been a Corvette option, but now you can buy one for your own car from any GM dealer. The one-note bugle, only six inches long, alerts you with an insistent, uninterrupted high-F above middle C. It can be turned off only with a key.



Rugged hold-down is all nylon

Flapping lids on overfilled car trunks are a hazard. Here's a heavy-duty web strap of nylon. An inch wide and 96 inches long, it has nonscratching plastic-coated hooks and a positive-locking nonslip buckle. The Tie-Down 68 fits over any car trunk. Market Forge Co., 35 Garvey St., Everett, Mass.



New filters for better engine protection

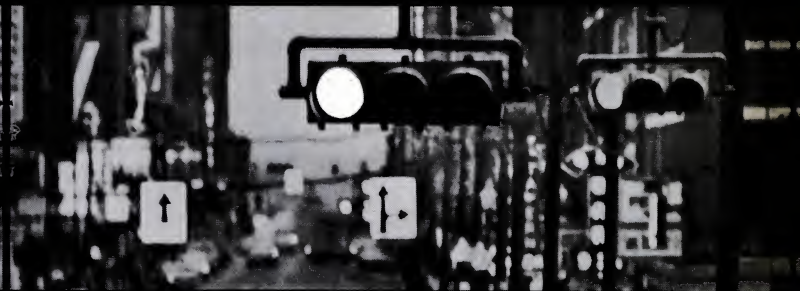
Fram's new air, oil, and fuel filters are designed specifically for high-performance engines. Most engine wear, says Fram, is caused by abrasive particles of 10-20 microns; the innards of these filters are of pleated cellulose rated at 15 microns. The oil filter can withstand 600-p.s.i. pressures—three times that of regular filters, the maker claims.



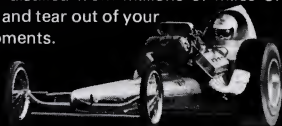
New air-powered auto-wrench kit

This new $\frac{3}{8}$ -inch square-drive air wrench comes with a full set of accessories. It gives you six hex sockets with finger-tip control of throttle, air regulator, and forward/reverse shift. The Black and Decker kit can speed up your work on transmissions, generators, fuel pumps, radiators, manifolds, and power steering. The kit sells for \$194.

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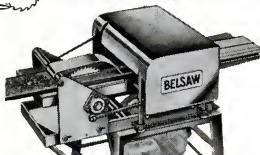


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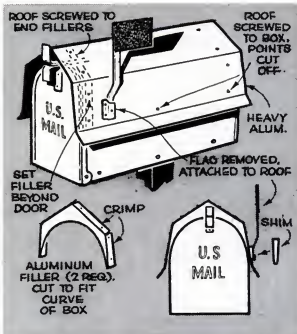
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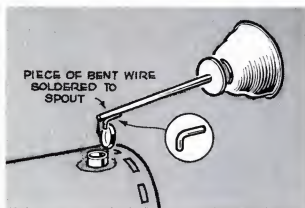
FROM HERE AND THERE



Mansard roof accents farm mailbox

Match your mailbox to your barn with an aluminum mansard roof. Since all bent angles can be shaped with a pair of boards or a vise, the sheet-metal work is simple. Make a cardboard pattern for the end filler pieces by tracing directly from the curve of the mailbox. Using self-tapping screws, secure the shaped roof to fillers, then attach roof to box. Relocate flag as shown in top drawing above.

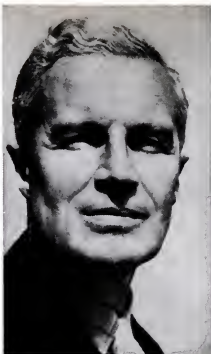
VICTOR H. LAMOY, Upper Jay, N. Y.



Spout hook opens oil-cup cover

Here's a simple, practical idea to help you open the covers of oil cups in hard-to-reach places. Solder a small hook, made from stiff wire and bent as shown in the drawing above, to an oilcan spout, about 1/4 inch from the end.

HAROLD G. ROSS, Cleveland.



I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish*. And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned*. I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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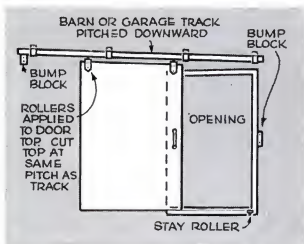
FROM HERE AND THERE



Midget mop cleans bent tubing

A tiny mop made from cotton and picture wire enables you to scrub the insides of bent glass tubing. After spreading the ends of the wire strands slightly, work them through the cotton. Bend back several strands sharply to hold cotton, then squeeze the wad to set the wire and compact the cotton. The flexible wire easily takes the sharp curves of glass tubing as seen above. If necessary, the miniature mop can be used with cleaning agents.

WALTER E. BURTON, Akron, Ohio.



Keep that door closed!

Let gravity automatically shut the door on a furnace room or other area that must be closed off for safety. Install a rolling-door track slightly pitched toward the opening. Cut the door to the same pitch, then add roller hardware. A stay roller (bottom right) will hold the closed door against the casing.

VICTOR H. LAMOY, Upper Jay, N.Y.

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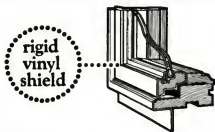
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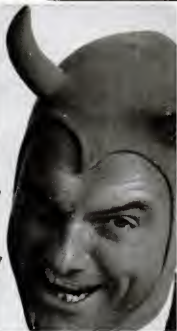
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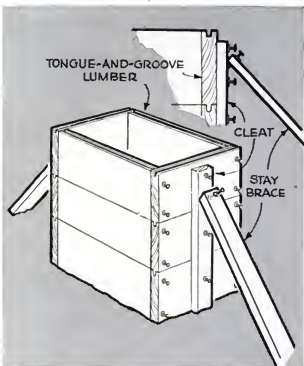
FROM HERE AND THERE



Yardstick draws big circles

You can draw perfect circles with a self-measuring compass made from two nails and a yardstick. Drive one nail through the yardstick and far enough into the stock to serve as a pivot; use the other as shown to scribe a big or little circle.

DARRELL HUFF, Carmel, Calif.



Easy way to make pier forms

Bottomless boxes made from tongue-and-groove lumber will stack to make interlocking pier forms. Make such boxes of different widths of lumber so it's easy to vary the height of forms as needed. A cleat tacked across the ends keeps the forms from separating vertically and lets you add a brace to hold the forms steady.

VICTOR H. LAMOY, Upper Jay, N.Y.



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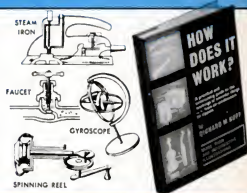
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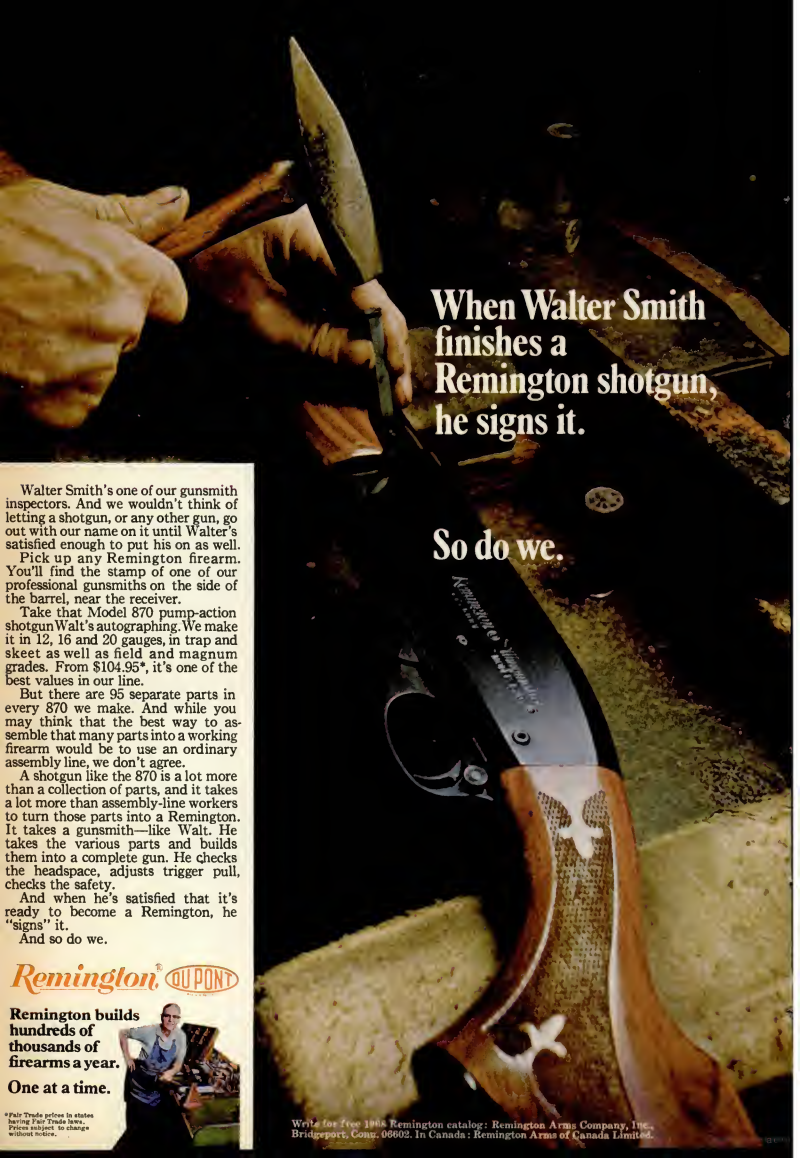
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How I Reached the North Pole on a Snowmobile

By **RALPH PLAISTED**

The amazing first-person story by the leader of a gallant band of do-it-yourselfers who rode to the top of the world on four ski scooters



A triumphant Ralph Plaisted unfurls flag of his native Minnesota at the North Pole (below) after a journey that covered 830 miles from Ward Hunt Island. The actual distance between the two points is 413 miles, but going around or hacking through pressure ridges like the one above doubled the distance.

Overhead, the big plane crisscrossed over us, circling and then cutting the circle into precise wedges. We stood around our snowmobiles below while the two navigators in the four-engine Air Force weather plane above verified our position. It was Saturday, April 20, 1968.

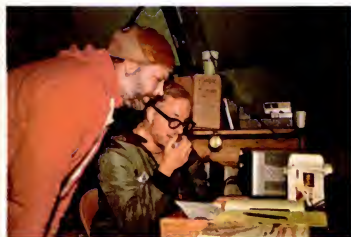
9:30 a.m. EST: Our radio blared a message from the pilot: "Everywhere from where you are now is South!"

We had made it to 90 degrees North—the first persons in history who could prove scientifically that they had reached the North Pole by trekking over the ice.

What's more, we were a group of

Continued





Andy Horton, a base camp communicator, talks to Plaisted party out on the polar ice, while Don Powellek is seen listening in over his shoulder.



John Moriarity stands at Plaisted cairn on Walker Hill, where the group deposited records of their trip. It's not far from the old Peary cairn.

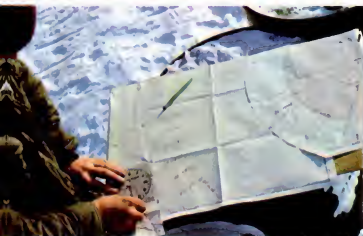
Walt Pederson starts Plaisted's snowmobile by warming the gas and air in carburetor with a torch—a piece of flaming rag on a wire. This was necessary in the minus-65-degree Arctic temperature.

By tilting snowmobile on its side as he revs it up, Pederson clears the track of encrusted snow. He was able to get it warmed up at the same time and check to see that it was running all right.





A day on the ice comes to an end as the party pitches a tent (left) to rest up for the "night," which was actually daylight because of the midnight sun. Tent was pitched within a square formed by the sleds and snowmobiles. This scheme made it easier to load and unload. Each morning, Walt Pederson (above), the party's mechanic, got the snowmobiles running and checked over all mounts and possible trouble points. He designed the plastic auxiliary tank to double fuel load.



Bush-Pilot Weldy Phipps plots course to the North Pole before taking off to pick up the victorious ice party and bring them back to the base camp.



Air Force plane flies directly over Plaisted party to check that they are at 90 degrees North, the true North Pole. Two AF navigators verified position.

Don Powellek holds a smoke bomb to give Pilot Weldy Phipps a wind-direction indication as the flier brings in his twin Otter for a landing at the Plaisted base camp. He was returning from a supply trip.



Pausing near the Pole to set up camp, Plaisted (left) leans over to get some gear out of sled, while Jean Luc Bombardier picks up a Coleman catalytic heater to warm the Arctic air in tent they will pitch.





Four who made it all the way were (left to right): expedition leader Ralph Plaisted, Walt Pederson, Jean Luc Bombardier, and Jerry Pitzl. Their backgrounds are completely varied. Plaisted is an in-

surance salesman, Pederson a former snowmobile dealer, Bombardier a public-relations man, and Pitzl a schoolteacher. But they meshed into an excellent team that functioned almost as one in their epic ride.

amateur explorers and we had come on little ski scooters just like those used by hundreds of thousands of snow-loving enthusiasts in the U.S. and Canada.

Actually, we weren't novices; not in the strictest sense. We had tried to drive to the Pole on snowmobiles last year. Although that attempt failed, we learned some valuable lessons on that expedition that convinced us we could do it.

First of all, we decided to go with a smaller group in '68. And we chose more powerful snowmobiles. In 1967, we used Bombardier Ski-Doos, powered by 250-cc., 10-hp. Rotax engines. This was done to keep the machines light and use less

gas. But we learned that often the extra power is needed and worth the extra gas.

This year, we used four stock Super-Olympique Ski-Doos, with 300-cc., 16-hp. Rotax engines. Our master mechanic, Walt Pederson, a former snowmobile racing driver, made some minor modifications, and these few changes really helped us to make it.

We installed an extra throttle on each machine so that we could accelerate with either hand. We beefed up the suspension with an additional leaf spring on each ski and reinforced the skis with a little rib of angle iron. Since we usually ride on our

[\[Continued on page 200\]](#)



The party is stopped by an open lead—water covered with ice too thin to cross. Snowmobiles had to circle it. Such obstacles doubled the distance traveled.

Weldy Phipps checks beacon located halfway to the Pole; it gave him a navigational fix in finding ice party. Beacon was powered by 3M generator.



Supply plane lands with vital fuel. Pilot Phipps never had more than 15 minutes' fuel reserve in his tank to search for the men traveling on the ice.

Phipps and Don Powellek (right) check beacon receiver in plane's nose. This homed in on signals sent out by beacon on left and one used by ice party.





Plaisted grabs a box of rations out of sled for evening meal for four—about 5,000 calories for each man. Their rations included three different breakfasts and five different dinners. The Pillsbury Com-



pany prepared 500 meals for the expedition, but only half were used. The evening meal took about 45 minutes to prepare, mainly because melting snow for water took so long. Box is 17 pounds.

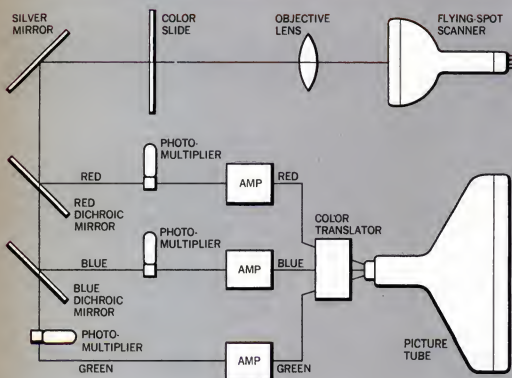
Part of the frigid Arctic vista (right) seen by Plaisted and his mates as they drove by on their snowmobiles: Icicles are "curing" themselves of salt content by dripping; solid, but pure, fresh water remains when brine is gone.



Navigator Jerry Pitzl takes a fix on the sun with a bubble sextant as party nears the Pole. His navigational accuracy kept them right on course.

Winds carved strange patterns in the snow traversed by the Poleward-trekking Plaisted group. But this kind of terrain proved to be "nice going."





HOW IT WORKS

Color-slide display on TV picture tube uses the same principle as a color-TV-camera pickup tube in a TV studio. White light-beam spot from flying-spot scanner passes through the color slide. The beam, containing all colors of the scanned slide, is projected through special dichroic mirrors, each of which reflects a specific color and allows the remaining colors to pass through. In this way, red and blue are in turn separated from the beam by the dichroic mirrors, while green passes through. These three basic TV colors are then amplified by photomultipliers, and are fed to the normal color-processing circuits of the set for screen display.

Now-See Your Slides on This New Color TV

By EVERETT H. ORTNER/PS Photography Editor and SAM SHATAVSKY/PS Electronics Editor

Everything you need for an evening's entertainment—except cold beer—is built into Sylvania's new Color Slide Theater.

Like color TV? Flip a switch and there's Walter Cronkite with the day's news, or maybe a swashbuckling pirate movie. Nothing else worthwhile on the TV schedule? Then how about looking at color slides for a while? Don't bother to take out your projector and screen—just flip another switch. On come your slides, right on the TV screen. There's even a voice—yours—accompanying the slides. And the slides change automatically to suit the narration.

Tired of that? Then how about some soft music while you close your eyes and relax? Easy—pop in a tape cassette and let the machine lull you to sleep.

Inside the machine, there's not only an automatic slide changer (Kodak Carousel), but also a miniature TV studio. As each slide drops down from the tray, a moving light beam scans it. The light spot is caught on the other side of the slide, separated into its component TV colors, amplified, and flashed on the screen. While color and sharpness will not compare with good optical projection through a standard slide projector, electronic projection offers its own advantages:

- You can alter the hues of a slide through the set's color controls.
- The TV feedback circuit automatically compensates for lighter- or darker-than-normal slides.
- Slides can be viewed in a fully lighted room, even in daylight.
- The low-intensity light won't harm your slides, and because there's no hot bulb (and no noisy blower), your slides won't pop in and out of focus. In fact, slides are always in focus.

Synchronized with the slide system is a cassette tape recorder. You speak into the mike while you're watching a slide, then press a button when you're ready for the next slide. That puts a silent electronic signal on the tape. On playback, the slide changes automatically when the tape reaches your signal.

The player will also play (monaurally) standard stereo or monaural prerecorded cassettes. Cost of the unit: \$995.





Engineers measure skid marks on runway.



Workmen cover runway with ice for slush tests.

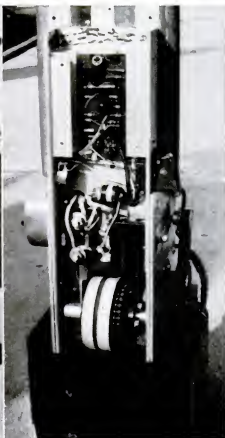
Grooving a runway to keep big planes from skidding

Engineers of the National Aeronautics and Space Administration are grooving runways to combat one of aviation's greatest dangers—skidding on wet pavement. At Wallops



Motorized skateboard uses battery power

Roy Hoskin of Arcata, Calif., built this electric skateboard out of aluminum sheet and extrusions. The board is driven by a half-hp. model-aircraft motor with a timing belt and chain drive to the wheels. Power is supplied by a 20-volt nickel-cadmium battery. It has a 12-transistor speed control and can carry its young rider up to 12 m.p.h.



Wireless TV camera has three-mile range

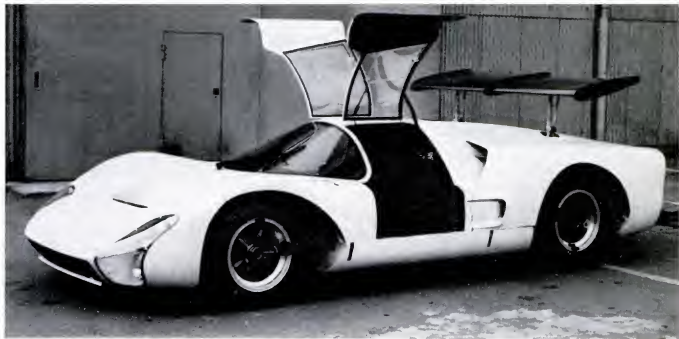
This new CBS 18-pound color-TV camera made its debut at last month's political conventions. It is the first portable camera that can transmit directly to a video-tape recorder, up to three miles away, without a cable connection or additional equipment, to make high-quality color tapes.



Big Convair 990 splashes down runway to test whether grooves can keep it from skidding.

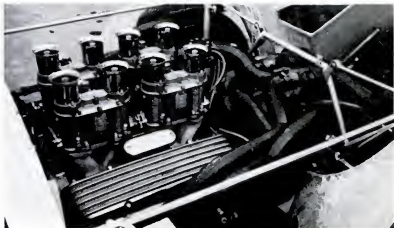
Island, Va., NASA has built a runway with quarter-inch grooves, spaced an inch apart, to see how they affect landings and takeoffs on wet surfaces. The grooves lead water off

the surface before it can form a traction-destroying cushion under the wheels of a fast-moving plane. Trials at several airports have been successful, experts say.



Japanese racer breaks records

The Nissan R381 is currently Japan's fastest car, with a top speed of 200 m.p.h. It recently won its first race. The engine is a 330-cubic-inch V-8 that puts out 450 hp., and the car weighs only 1,881 pounds. The "wing" at the rear keeps the tail on the ground at high speeds, and helps slow the car down. The body is fiberglass-reinforced plastic, strengthened with steel pipe and honeycomb plates.





Come for a ride in a "modern" external-combustion-engine car. You just might be able to buy one in three years

By DEVON FRANCIS

Williams steamer produces top of 230 hp. —less on early "cutoff"—goes 120 m.p.h. on 56-cubic-inch in-line, four-cylinder engine. Williamses claim 20-30 m.p.g. When cold, car needs 35 seconds to get up steam.

Is There a Steam Car

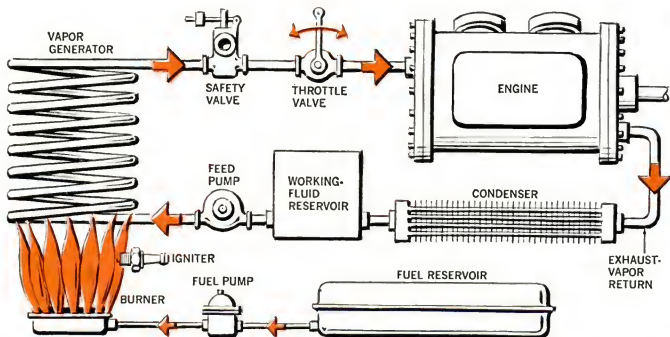
Outside the office of a research organization in suburban Rochester, N. Y., stands an automobile that looks like a customized convertible powered by a conventional gasoline engine.

It isn't. It's a steam car, an up-to-date version of those contraptions that were still hissing along U. S. highways as little as a generation and a half ago.

This steam-propelled vehicle—one of several that are now the subject of study

by responsible government and industry groups in this country—bears a special significance. A car with an *external-combustion engine* (ECE) such as this one's, as opposed to an *internal-combustion engine* (ICE) like that in your family automobile, could be sitting in your driveway in the next three years.

The federal government may launch a crash program to develop this kind of automobile. The reason, of course: ICE



Typical "modern" automotive steam engine has water tube generator with fire around it—unlike

Stanley with fire tubes heating a boiler of water. Condenser turns exhaust steam back into water.



Thermal Kinetics steamer was built by Charles F. Keen, Madison, Wis. It has two power settings—low fire for poking along, high fire for top speed. It gets 10 miles per gallon.

in Your Future?

vehicles are the nation's chief cause of smog.

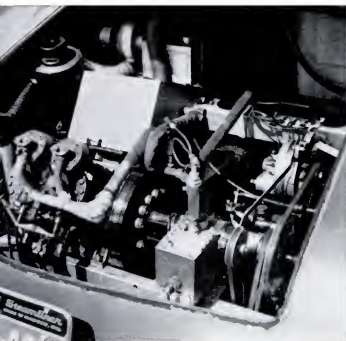
Like a household oil burner, EC automotive engines are almost pollution-free, as was proved in a recent test of an EC car of 120 hp. built by twin brothers, Charles J. and Calvin E. Williams, of Ambler, Pa.

A report prepared for the Department of Commerce last October recommended that to preserve the national resource of

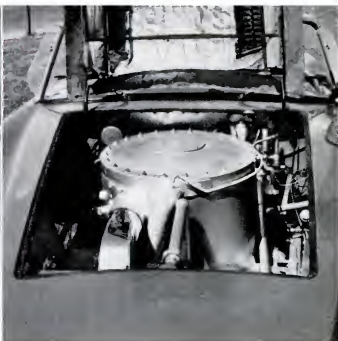
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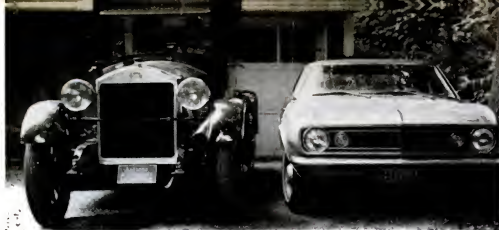
Dials show water-reservoir level, generator heat, pressures of fuel, steam, and inlet water at pump.



Rear-mounted V-4 (left) chain-drives a 2.25:1 axle. A sump vacuum removes blowby steam. Steam from



boiler under hood is pumped to engine's inlet poppet valves. Exhaust is like that of a two-cycle ICE.



Stanley Steamer of 1923, owned by Frank B. Springer Jr., Newark, Del., towers over author's Camaro. Cold, it raised operating steam in 25 minutes.



Springer ignites pilot light on oil burner with blowtorch.

clean air, the federal government initiate a five-year program, costing some \$60 million, to explore, among other things, "energy sources for vehicles" and "vehicular propulsion systems."

The report dismissed electric cars as economically unfeasible at this time except for special-purpose, limited-range use, and termed the gas turbine—subject of several years of research by Chrysler—unsuited to automobiles.

Too complex? Not needed? Last May, ECE enthusiasts, including the Williamses and Charles Gill, head of Thermal Kinetics of Rochester, testified before a U.S. Senate subcommittee studying air pollution. Spoken for Ford and General Motors also testified. Detroit's posture was that the ECE is a lot more complex than the ICE, and by 1970 research probably will cut the ICE's pollutant emission as much as 90 percent.

Both Ford and GM said they were actively exploring ECEs. Some years ago the Williamses demonstrated their car to Chrysler Corp. officials. The ensuing silence was deafening. A changeover by Detroit to new production methods would cost billions.

Test drive. I took the Rochester steam car, owned by Gill, for a test drive. I slid into the driver's seat from the right side. There's no door on the left. In that spot is the lever for the cutoff valve that regulates the duration of the steam charge into the engine cylinders.

Stone-cold on a 60-degree day, the engine fired up enough steam in 20 seconds to take off. I almost got in trouble by pressing too hard on the accelerator—the torque output at standstill is breathtaking. Bathed in a faint aroma of burnt kerosene, the car ran spooky-quiet. It was almost vibrationless. It topped 60

m.p.h., yet when I let off on the accelerator and slammed the brake pedal, the car stopped like a mule with a spike bit in its mouth. The engine simply wasn't turning over any longer. That's the way it is with ECEs.

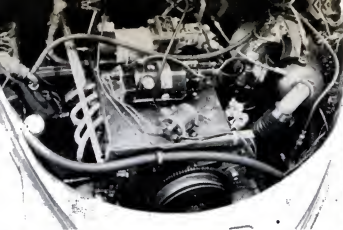
How good are ECEs? That depends on who's doing the talking.

Like its forebears—the famous Dobles, Whites, Stanleys, and Locomobiles of yesteryear—a typical current EC engine burns fuel in a furnace outside the engine to make steam. The steam is ducted into cylinders to drive conventional pistons that turn a crankshaft. An IC engine burns an air-fuel charge inside itself.

The good side. On the face of it, an EC steamer should be a paragon of all the virtues. It doesn't have the ICE's "parasitic auxiliaries"—starting motor, carburetor, cooling system, complex ignition wiring, muffler, or smog-control devices. It will burn practically any combustible product, including paint thinner. (Some



1906 Stanley Gentleman's Speedy Roadster was shown by S. W. Ellis at a steam buffs' meet.



Forty-hp. Mercury outboard has been converted to steam and mounted in a Volkswagen, in Santa Ana,



Calif. Car owner William J. Smith claims 250 hp. at 6,000 r.p.m. and steam generation in 14 seconds.

steam buffs joke about using Chanel No. 5 perfume.)

Unlike the ICE, it doesn't need r.p.m.s to produce high torque at vehicle takeoff from a light—its torque is greatest at stall. It doesn't need the ICE's reduction-gear transmission.

One of the most winning qualities of the steam ECE is its "cutoff" for steam flow into the cylinders. For high power, the steam surges in for 75 percent of the power stroke; at high-speed cruising, for 18 or less. This saves fuel.

Its crankshaft revolves at half the speed of an ICE's, reducing wear. Even a "single-acting" ECE produces power on every other stroke, like a two-cycle ICE. It dissipates perhaps 10 percent of its energy in the power train as against 40 for an ICE. It never needs tuning.

Its present "working fluid" is water. Steam is chemically stable even when heated to tremendous temperatures.

"Modern" steamers, that of the Wil-

liamses, for one—and indeed, the famous Doble of 36 years ago—are sophisticated. Their "flash" boilers produce almost instant steam, their condensers liquefy it for re-use, and their engines are marvels of engineering. These can be double-acting, producing power on each stroke as steam is valved into first one end of the cylinder and then into the other. The engines can also be "compounded" to use super-hot steam in primary cylinders and then duct it as it loses heat into secondary cylinders for added power.

And the problems. But, alas, the ECE has its problems—many of them hinging on the obstinacy of water. Water freezes at 32 degrees F. Present antifreeze compounds break down before they reach the 800-1,000-degrees steam temperature needed for efficient automotive operation. ECE proponents have two answers to this: Keep a pilot light going under the water reservoir in cold weather, or sub-

[Continued on page 210]



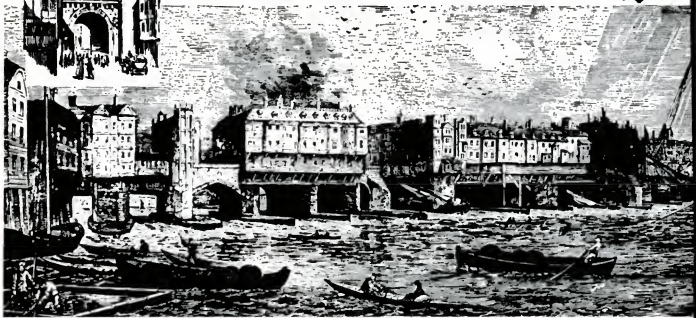
1910 White Steamer, owned by James A. Weidenhammer, was fired up at the same meet in Vermont.



1904 Stanley Steamer is the handsome possession of enthusiast Louis R. Biondi of Waterbury, Conn.



London Bridge



PAST Most picturesque of several London Bridges of bygone days, this one completed in 1209 was adorned with houses, shops, and a chapel at the middle. Its gateway (in-

set) was decorated at top with heads of criminals on pikes. A wonder of medieval world and center of London life, the bridge lasted six centuries and was still standing when erection of present one began.



PRESENT This is the London Bridge that is coming to the U.S. Pictured before dismantling, the 137-year-old structure was completed in 1831, when King William IV

(Queen Victoria's predecessor) ruled Britain and Andrew Jackson was U.S. President. Since it no longer can cope with mounting motor and pedestrian traffic, it will be replaced by new bridge, below.



FUTURE New London Bridge, to be built of prestressed concrete, will look like this when finished in 1972. Wider than present one, it will have six lanes instead of four,

and only two midstream piers. Its up-to-date style should please the modern-minded, but may horrify London's antiquarians—who must be content to know that the former bridge has been preserved.

Comes to America

Taking apart a famous span and rebuilding it in Arizona is giving engineers the world's biggest "jigsaw puzzle"

By DAVID SCOTT and ALDEN P. ARMAGNAC

Block by block, historic London Bridge is on the way to the United States.

Deciding to replace it with a modern one, the Corporation of the City of London recently offered the famous 137-year-old Thames River span for sale. A U.S. firm, the McCulloch Oil Corp. of California, bought it for \$2,460,000.

Entering the U.S. duty-free as a "large antique," London Bridge will be rebuilt on dry land at Lake Havasu City, Ariz. Then engineers will create an artificial river to flow under it. The restored London Bridge is expected by McCulloch to make a major tourist attraction and draw a five-fold increase of visitors to this Ari-

zona community, which the company is developing as a tourist resort, recreation area, light-industry site, and retirement haven.

Transplanting a bridge. How do you move a 1,005-foot stone bridge across the ocean? First, to picture the task, what is coming here is London Bridge's "facing" or exterior. It consists of 10,000 tons of granite blocks—quarried long ago in Aberdeen, Devon, and Cornwall, and ranging in size from half a ton to five tons apiece.

London Bridge's unseen "core," consisting of lengthwise brick walls with gaps between, is not included in the purchase and will be disposed of as rubble—120,000

Continued

NEW HOME Brought to U.S., London Bridge will be rebuilt in Arizona, as link in highway on peninsula jutting into Lake Havasu. Then a waterway will be

built under it, making the peninsula an island reached by the bridge. On this aerial photo of the site, an artist has drawn in the reconstructed bridge and waterway, to be called the "Little Thames."





Down comes London Bridge—and its voyage across the sea begins

Stone by stone, London Bridge is dismantled for shipment to America. Versatile machine atop center arch acts as crane to lift away one of projecting supports of walkway, after loosening it. Radial

arch-stones—essential to hold up bridge while it is still in use—will be removed last, with aid of a steel gantry. Seen beyond arch is Tower Bridge—a comparative newcomer, dating back merely to 1894.

tons of it. Engineers at the Arizona site will build a whole new “core bridge” of concrete—structurally complete in itself—and attach the 10,000-ton facing of London Bridge to it.

Taking down the Thames span, a three-year task, already is well under way. A versatile crawler-tread machine called a hydraulic excavator loosens a facing stone from its mortar by wielding a pneumatic breaker, resembling a giant toothpick. Then the machines act as cranes to lift the stones away. Blocks beyond their reach are loosened by men with pneumatic drills and hoisted aloft. Despite the battering it takes to dismember the durable facing, only three blocks in 100 get broken; these can be repaired with epoxy-resin cement, or replaced from elsewhere in the bridge.

Stones get numbers. To help solve the world's biggest “jigsaw puzzle”—where individual stones belong—numbers are applied as they are removed. The numbering plan divides the bridge's north-south length into eight sections. In a typical number, 3H03, the first 3 means the third section from the north end; H denotes the level of one of its rows of facing stones; and 03 is the third stone in that row. The rebuilders get numbering-plan diagrams,

and photographs of important details, for their guidance.

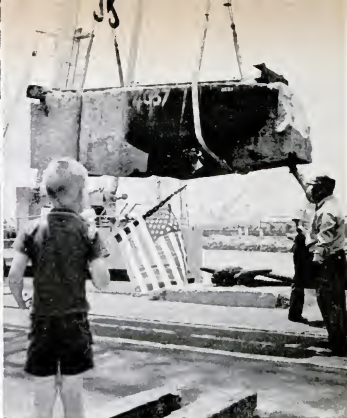
Dismantled blocks go to a Thames dock to be put on cargo ships bound for Long Beach, Calif., whence they are trucked to Lake Havasu City. The first shipload, an 850-ton installment of London Bridge, arrived at Long Beach last July 4.

Famous earlier London bridges. Far from the first of its name, the London Bridge that America will get inherits added glamour from its predecessors.

A London Bridge of timber, wide enough for “two waggon” to pass and fortified with low parapets, became immortalized in song when marauding Norwegians pulled it down in the year 1014. A Scandinavian saga hailing the feat, with the words “London Bridge is broken down,” inspired the timeless jingle, “London Bridge is falling down, my fair lady.” But the most fabulous London Bridge was a stone structure of 20 narrow arches, completed in 1209, from which rose multi-storied houses and a chapel, too. So sturdily was it built that it was still standing six centuries later, though the houses had long since gone. Then came the present London Bridge, designed by John Rennie and opened in 1831.



To show where stones belong, they get numbers, viewed at scene of dismantling by hard-hatted PS editor Scott. Block is numbered roughly with paint before its removal; then, with Scotch-tape cutout, lacquered over for weather protection. This stone is a piece of the facing below the walkway supports.



Ocean-voyaging block from London Bridge is unloaded at Long Beach, Calif.—in Fourth-of-July ceremony watched by small boy with flag—as Norwegian freighter S.S. Fossum delivers first 850-ton installment of 10,000-ton purchase. By truck, stones make 300-mile trip from Long Beach to Arizona site.

Like an old master among paintings, Rennie's five-arch stone bridge is revered today as an "outstanding example of 19th Century skill in masonry design and construction." It went up for sale only on the express condition that it would be preserved—by reassembling its blocks into "a new bridge of similar shape and size." (An even higher bid than McCulloch's princely one was rejected because it did not meet this requirement.)

Why must it be replaced? Although widened in 1902 from 56 to 65 feet by adding projecting walkways, the four-lane London Bridge no longer can cope with growing motor and pedestrian traffic. Also, under the vibration of modern traffic and its own 130,000-ton weight, it is slowly sinking into the river bed—an inch every eight years.

London's new bridge. The London Bridge of the future will be a modern six-lane structure of prestressed concrete—built at exactly the same site, and using the same approaches. It will accommodate 2,750 vehicles hourly, plus the 20,000 pedestrians who cross the bridge twice daily—suburban commuters trudging between rail and subway stations at the bridge's south end and the financial district at its north end.

To avoid interrupting traffic, the new bridge will go up as the old one comes down. As soon as the Rennie bridge's facings are "skinned," the new bridge's outer lanes will rise alongside, allowing traffic to be diverted to them. Then, removal of the rest of the 1831 bridge will permit completion, by mid-1972, of the new one's inner lanes. A fourth of the new bridge's cost will have been paid for by the present one's sale.

Old bridge's new home. American rebuilders of London Bridge, meanwhile, will have the advantage of erecting it out of the water. Its site is on the neck of a peninsula jutting into a 100-square-mile lake formed by Parker Dam on the lower Colorado River—Lake Havasu, whose Indian name means "blue waters."

But any self-respecting bridge ought to go over something—and so they will dig a mile-long channel across the neck of land and under the bridge. When the channel's ends are opened to the lake, an artificial river, navigable by pleasure craft, will flow beneath the bridge—and the span will serve the resulting island. Both the rebuilt London Bridge and the man-made waterway, which is to be called the Little Thames, are expected to be completed in 1971.

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WANKEL-TYPE ENGINES: New Kind of Power

Here's a test report from snow country on a zingy RC engine that pours on the horsepower, yet makes snowmobiling easy on the ears

The first thing you notice about a snowmobile powered by the new RC engine is how easy it is to start. I'm used to the balky starters on the two-cycle engines. When I gave a healthy tug at the rope of a Polaris Colt equipped with the new Curtiss-Wright power package, I almost fell off backwards.

The little rotary-combustion engine starts easier because it has so little compression to overcome, thanks to the design of its rotor seals. The seals function as compression-relief valves at very low r.p.m.

Purr-purring along. Once the engine starts, you get the next sign that there's something new in snowmobiling—it's much quieter. The sporadic putt-putt you usually hear when you ride a snowmobile with a two-stroke engine is replaced by a pleasing purr. And when you gun the throttle, the quiet carries over to where you're riding flat out.

The RC engine requires about a five-hour run-in at no more than 50-percent power to properly seat the apex seals. This is similar to running-in a piston engine to seat the piston rings. After the seals are seated, you can rev up the engine—even to full throttle—without fear of seizure. The smooth combustion cycle delivers a powerful torque and a quick response to the throttle.

The little power plant is extremely compact. It's 12.32 inches high, 12 inches wide, and 14.29 inches long. Including starter, filter, and muffler, it weighs only 56 pounds, or 15 to 20 pounds less than a two-stroke engine of comparable size. With a displacement of 18.5 cu. in., it delivers 20 hp. at 5,000 r.p.m. That's a lot of power for a ski scooter.

Out in the snow. As I put the Polaris through its tricks, the RC engine seemed to develop



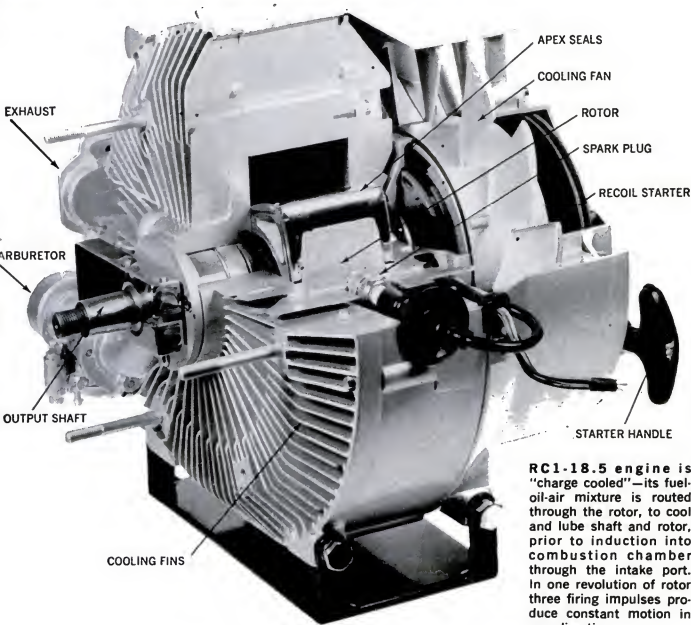
PS reporter Herb Shuldiner tests a Polaris Colt, powered by a Wankel-type engine. The new engine accelerates more quickly than two-strokers and delivers more consistent combustion, tests showed.



With snowmobile cowling removed, Curtiss-Wright engineer Vincent D. Pohlmeier shows how little room the engine occupies. Compact RC weighs 15 to 20 pounds less than comparable two-cycle engines.

for Snowmobiles

By HERBERT SHULDINER



RC1-18.5 engine is "charge cooled"—its fuel-oil-air mixture is routed through the rotor, to cool and lube shaft and rotor, prior to induction into combustion chamber through the intake port. In one revolution of rotor three firing impulses produce constant motion in one direction.

torque quicker than a two-stroker. Acceleration was quicker, and I got a faster pickup when varying speeds, too.

To the rider, the snowmobile seems to have a lower center of gravity with the lighter engine, giving you the feeling of a solidly steady mount and a stable ride. There's also far less vibration—a welcome change. Traversing rutty snow fields shakes you up enough.

The engine needs no special accessories for snowmobile installation. It uses a standard flyweight recoil starter, a

Bosch ignition system, and a Tillotson carburetor. These are all common snowmobile items, so there's no difficulty when you need servicing.

You'll find the RC engine on Arctic Cats and Trail-A-Sleds, too. This is the second season for Wankel-type engines on snowmobiles—long enough to get out the kinks and to indicate how well they stand up in use. If you're bugged by noise, then you might be wise to select your next snowmobile with an RC engine. It will give you a quiet, pleasing ride.

Which Lightplane Design Is Best?

Experts give the facts about a question hotly debated by private-flying enthusiasts—high wing or low wing?

By ROBERT I. STANFIELD

You may be one of the 190,000 pilots beginning their flying careers this year. Like many, you may be asking: "Shall I start in a high-wing or a low-wing airplane?"

You'll find squarely conflicting views in the makers' literature on single-engine airplanes—which make up the bulk of general-aviation aircraft for business, pleasure, and primary training. A leading aviation magazine branded low-wings "a freak class of airplane" some years back; more lately, another relegated high-wingers to "the older planes, of the pre-1960s." Ask a group of experienced pilots, and the pros and cons will fly back and forth, in a heated argument.

What are the facts? If there weren't be two basic types.

Here is the case for "high" and "low." It presents the thinking both of pilots and makers. For the latter, we've chosen the Big Five that lead in manufacture and sale of lightplanes: Aero Commander, Beech, Cessna, Mooney, Piper.

High wing. The high-wing design is a basic feature of Cessna and Aero Commander single-engine aircraft. (Exceptions are each maker's special-purpose agricultural aircraft—Cessna's Agwagon, the Ag Commanders.)

Advantages of high-wing design include these points:

Getting in and out is made easy. A low cabin floor, and low-sill doors on each side of the fuselage, obviate climbing on a wing for cabin entry and exit.



**LOW
WING**



**HIGH
WING**

Piper single-engine airplanes illustrate low-wing design. Its adherents point to visibility upward and sideward, strut-free wing for speed and economy, structural advantages for placement of landing gear.



Cessna single-engine airplanes exemplify high-wing design. Those who favor it emphasize visibility downward, stability (because weight hangs beneath wing), ease of getting in and out on the ground.

LOW WING



Pilot sees area toward which he's turning. Inside wing dips out of his line of sight, as the Beech airplane shown above banks.



Wide-tread landing gear can be mounted on wing, as on this Piper.

HIGH WING



Best "lower-hemisphere" visibility is provided—as for pilot of this Cessna.



Wingtips safely clear low obstacles that could damage a low wing in takeoff and landing, as this Aero Commander shows.

The floor is flat, (A low-wing design must provide for a carry-through spar.)

Downward ("lower-hemisphere") visibility in flight and taxiing is enhanced.

The high wing makes a bad-weather "shed" for passengers and baggage during loading and unloading. Both on the ground and in the air, its protection gives a cooler passenger compartment.

Fuel flows naturally by gravity from a high-wing cell to the engine.

Wingtips stand less chance of damage in taxiing and takeoff and in landing among "low-profile" obstacles.

Interference drag is low at the intersection of wing root and fuselage. (With a low wing, careful filleting is required to offset higher drag here—and avoid a separated wake, extending back to the tail surfaces, that can impart a rolling motion to the aircraft.)

Stability is generally better, because the center of lift is above the center of gravity. This minimizes roll, and tends to right the airplane from a bank. (In low-wing aircraft, with the center of lift

below the center of gravity, lack of this stabilizing effect is offset by building in greater dihedral—inclination of the wing from the horizontal.)

Low wing. The low-wing design is a basic feature of the single-engine lines of Beech, Mooney, and Piper. These points are advanced in its favor:

A low wing offers an ideal place to attach fixed landing gear, or to stow retractable gear. It eliminates heavy bulkheads to transfer landing loads between wing and gear—thus saving weight. Attaching the main gear to the low wing also permits a wide tread, giving a better "turnover angle" in high winds and gusts—both on the ground, and during crosswind takeoffs and landings.

Visibility upward and sideward is unrestricted, since the pilot sits on the leading edge of the wing. In the traffic pattern, in close-to-the-ground maneuvers, and while banking, the pilot does not lose sight of his approach and of traffic behind. The inside wing dips out of his line of sight when he is making a turn,



Fuel caps, as on this Mooney, are accessible for preflight check.



"Air-cushion" ground effect, in low-wing plane like this Piper, is said to help pilot level off flight path and make smooth landing.



High wing of the Cessna would provide shelter for passengers and baggage, in bad-weather loading and unloading.



You just step in or out of high-wingers like this Cessna—no need to climb a wing.

and wants to see the area toward which he is turning. (By contrast, a high wing's root limits visibility during a bank.)

A low wing provides easier "runs" for aileron controls; in the high wing they tend to be longer and more complex.

Fuel tanks, flaps, and ailerons of low-wing aircraft are more easily accessible for the pilot's preflight check. (With the high wing, a ladder is usually needed to remove fuel caps.)

If a pilot switches from a single-engine plane to a multiple-engine one, the low-wing pilot will be more at home. Most twins are low-wing.

A low wing's cantilever design generally gives more speed and long-distance economy than a high wing with drag-inducing struts.

Somewhat easier landings are claimed when the wing is close to the ground, from the air-cushioning ground effect.

The low wing helps a designer to control the manner in which a wing stalls. It is possible to design the wing so that

[\[Continued on page 206\]](#)

U.S. SINGLE-ENGINE AIRCRAFT PRODUCTION*

Year	High Wing	Percent of Market	Low Wing	Percent of Market	Total Aircraft
1964	4,116	57	3,077	43	7,193
1965	5,338	58	3,882	42	9,220
1966	7,448	60	4,966	40	12,414
1967	6,037	55	4,924	45	10,961
Total:	22,939	58	16,849	42	39,788

*Excluding military and agricultural aircraft.

"BIG FIVE" PRODUCTION

Year	Cessna (High Wing)	Aero Commander (High Wing) ^o	Piper (Low Wing)	Beech (Low Wing)	Mooney (Low Wing)
1964	3,864	...	1,786	568	600
1965	4,922	...	2,360	777	749
1966	6,915	13	2,982	884	756
1967	5,455	132	3,377	806	628
Total:	21,156	145	10,505	3,035	2,733

^oFigures for the Commander 100 only.



Medicine is discovering that common ice cubes can be a potent weapon for attacking sore muscles and painful bodies to make them feel good again

By LAWRENCE GALTON

Next time you get a burn, sprain, insect bite, even a backache—cool it. Cold treatment, with just plain ice cubes or other frigid applications, is making big news in medicine.

Recently, cryosurgery—the use of ice scalpels cooled to 200 or more below zero by liquid nitrogen—has been turning out to be good for everything from making diseased tonsils slough themselves off bloodlessly to treating cancers. And now, massaging everyday aches and pains with cold suddenly has become important enough to get a special name: cryokinetics (from the Greek words for cold and movement).

Says Leo Murphy, trainer for the pro

football Cleveland Browns: "Charley horses, pulled hamstrings, sprained ankles, strained shoulders—you name it, we got it. We're using ice on all these things."

So are more and more physicians. And there may be occasions when you can put ice to good use yourself.

First the shock of intense cold hits you, but then comes pain relief and relaxation.



The Hottest Thing for Your Aches and Pains



PHOTO BY ORLANDO GUERRA

To get moving again. The interest in cold for treating aches and pains began a few years ago when Lt. Col. Arthur E. Grant and a team of Army medics at Brooke General Hospital, Fort Sam Houston, Tex., tried massaging GIs with ice cubes so the men could perform exercises and get moving again. It worked, even for bursitis.

Over 30 months, the Army medics treated 7,000 patients this way, including many with chronic aches and pains. Results varied with age and length of time a condition had persisted—but they were preponderantly good.

More than 95 percent of the younger men and 85 percent of those over 40 with acute conditions of recent origin benefited from three or four ice-massage treatments—many from just one. In chronic conditions that had lasted three months or more, there were successful results for almost 85 percent of the younger and 75 percent of the older men.

Recently, Dr. Alexander D. Raptou, an assistant professor at the University of

Texas Southwestern Medical School, reporting on cold therapy for sprains, strains, and other musculoskeletal pains, urged physicians to make greater use of it and to teach patients to use it at home. No other method, he says, produces such a high rate of improvement with a single short treatment.

It's important in an acute musculoskeletal problem, Dr. Raptou notes, to initiate early motion—otherwise inactivity adds to the problem. And cold not only helps by producing some skin anesthesia but also by relaxing tight muscles and decreasing resistance to stretch. As a result, exercise can be performed with ease, and early return to normal motion becomes possible.

An ordinary ice cube can be used—or,

Continued



Those little cubes in your refrigerator tray will treat your aches.

First, there's the shock of intense cold—followed by

Dr. Raptou suggests, a large cylinder of ice can be made by freezing water in an eight-ounce paper cup. When removed from the cup, this chunk of ice is easier to grasp and hold, and can cover a larger area. Massage with the ice—done lightly in a circular or back-and-forth motion—takes seven to 10 minutes in most cases. For a minute or two, there's a feeling of intense cold, followed by numbness, pain relief, and relaxation.



Ice water is great for burns—eases the pain and prevents swelling.

Ice water for burns. Cold is proving to be an excellent treatment, not only for mild burns, but for some severe ones. At Kansas University Medical Center, doctors studying hundreds of burns have found that early cooling not only eases pain but prevents tissue swelling. As much as 85 percent of total swelling develops within 30 minutes after a burn or scald. Quick surface cooling stops the

changes in tiny blood vessels that produce oozing and swelling.

Moreover, cold water reduces scarring and promotes healing of burned flesh. A striking illustration of this came not long

ago when a workman who had been scalded by steam received ice compresses on all burned areas except one tiny overlooked site. Next day, all the burned skin treated with ice was healed but the neglected patch blistered and took two weeks to heal.

Doctors advise that a burned area be treated as quickly as possible. If liquid soap is available, it's a good idea to use it, along with cold water, to cleanse the site. Then the area should be immersed in water cooled with ice. If the face is involved, continuous cold compresses can be used. Depending on burn severity, cold treatment should continue from 30 minutes to four or five hours. If the burn is severe or extensive, there should also be medical attention as soon as possible.

One interesting discovery was made by Capt. Sidney I. Brody, a Navy medical officer: In many sore throats, the pain may not originate in the throat but in sensitive little areas in neck muscles—and often the sore throat can be relieved by applying cold to the muscles. Capt. Brody used a freezing spray of ethyl chloride.

In a study of 150 patients, adults and children, with and without fever, and even with swelling and redness of the throat and involvement of the tonsils, Capt. Brody has reported, the freezing treatment worked in three of every four cases.

Dr. Janet Travell, who was President Kennedy's physician, has long advocated

How medicine is using subzero cold to fight disease

It was only seven years ago that Dr. Irving S. Cooper, a neurosurgeon at New York's St. Barnabas Hospital, opened the modern era of the "cold knife" with his cryoprobe. His new kind of operating instrument was a hollow tube, insulated throughout except at its silver tip, and connected to a source of liquid nitrogen. By regulating a valve controlling the flow through the tube, he could cool the tip down to minus 196 degrees C.

The cryoprobe could freeze just a tiny specific target site, leaving surrounding tissue unaffected.

Cooper began work with it on patients

with Parkinsonism, or shaking palsy, a disease that produces uncontrollable tremors. Today, cryosurgery for Parkinsonism is being used in hospitals all over the world.

Dr. Cooper also has markedly reduced intention tremor of multiple sclerosis by freezing part of the thalamus.

Other surgeons have been applying cryosurgery to many other conditions:

Glaucoma, a common cause of blindness in which excessive pressure builds up within the eyes. A liquid-nitrogen probe touched for just a minute to half a dozen spots around the iris reduces pressure by slowing down fluid production.

numbness, relief, relaxation

cold therapy and used a freezing ethyl chloride spray for muscle cramping or spasm, a common problem after painful injuries.

It's as if the body were trying to do a splinting job—protecting the injured area by pulling the muscles taut so there's no movement of the area. But then the spasm itself becomes painful, and a vicious cycle may be set up: more pain, more spasm—and more spasm and still more pain. Numbing cold, Dr. Travell thinks, interrupts the nervous feedback cycle. After cold treatment, she reports, "we can pull the cramp from a muscle." And cold treatment often eliminates need for traction—slow stretching of a muscle back into shape.

Even for rheumatoid arthritis, cold may be better than the long popular use of heat, says Dr. Sedgwick Mead of the Kaiser Foundation Rehabilitation Center in Vallejo, Calif. Cold, he finds, reduces pain; it also decreases fluid accumulation and swelling; and it induces general relaxation. At the Center, cold compresses applied to arthritic joints also allow patients to perform exercises designed to increase their ability to get about and to progress toward caring for themselves.

Subject to nosebleed? Bleeding often can be stopped by simply pinching the nostrils together and applying cold wet towels to the face. But doctors sometimes are faced with the problem of a nosebleed that is severe enough to be life-threatening.

Cataracts, clouded eye lenses that ruin vision. A cryoprobe makes removal easy.

Detached retinas are welded back into place in the eye at Cornell Medical Center with a cryoprobe.

Meniere's disease of the inner ear. Dr. William F. House reports relief of vertigo, reduction in ear noise, and prevention of further loss of hearing after inserting a cryoprobe through the eardrum.

Cancer of the prostate in more than 200 men has been treated by Buffalo surgeons M. J. Gonder and Ward Soanes. With conventional surgery, about two percent of men undergoing prostate removal die—mainly from blood loss. With bloodless cryosurgery, which takes eight to 10 minutes, there have



An icy spray is used by a Navy doctor to relax neck muscles that cause sore throats.

At the University of Pittsburgh, Dr. Charles D. Bluestone has turned up another important use for cold—a deep-freezing kind.

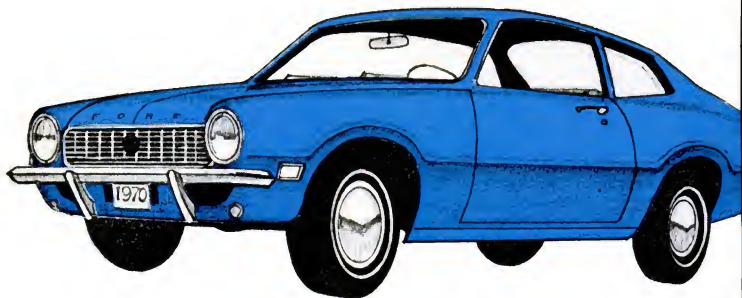
Dr. Bluestone found that by placing a tiny balloon in the nose, then filling the balloon with 95-percent alcohol cooled to minus 20 degrees C., hemorrhaging can be stopped even in patients who continue bleeding after nasal packing is inserted both from in front and from behind. Bleeding was stopped in every one of 21 such patients. For them, the "cryoballoon" was used as a last resort—but it may have more than last-resort value from now on.

What else is cold good for? Back at the ordinary, everyday pain-and-ache level, many doctors recommend ice packs for severe bruises to help reduce swelling as well as pain; and cold cloths to relieve discomfort after a wasp or bee sting. ■

been no deaths. The diseased gland gradually deteriorates into a sludgy mass that breaks into small pieces and drains away.

In their prostate cryosurgery work, Drs. Gonder and Soanes have noted a phenomenon that may have great potential significance. In some cases, the cancer had spread beyond the gland. And after the prostate was frozen and its cancer destroyed, the cancer tissue that had spread beyond the gland shrank.

Nobody knows why—but there is a theory that freezing somehow may induce the body to manufacture defense agents, antibodies, against cancer, and these may travel about seeking and attacking cancerous tissue. That possibility is now getting study.



Ford's Small-Car Prototype Will Be 1970 FALCON

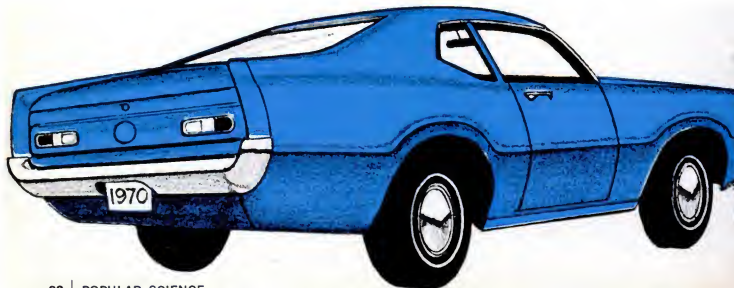
By JIM DUNNE
PS Detroit Editor

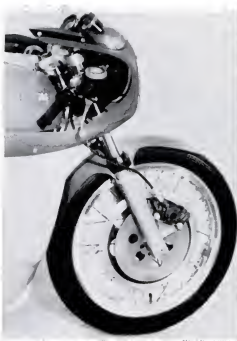
Ford will launch its counterattack on the import-car invasion next May in the form of a new subcompact now in prototype and known by the code name, Delta. According to most predictions, it will carry the Falcon name and replace the two-door Falcon. The four-door Falcon will continue through 1970 in its present size.

The new car is high-styled but mechanically simple. Length will be 176 inches (8.3 shorter than '69 Falcon) and wheelbase 103 inches (eight less than '69 Falcon). Weight is estimated at 2,450 pounds (almost 400 less than the present Falcon). With the same 100-hp. six, it should be quite lively. It has coil-spring front suspension, and an I-beam rear axle with leaf springs.

Only one body is planned—a two-door coupe. Curved side glass and ventless door windows contribute to its modern appearance. Head-on, the car is dominated by single headlights bracketing a black plastic grille of "egg crate" design. The hood line slopes sharply down from the windshield base. The body, of unit construction, is based on a shortened pre-'67 Mustang chassis.

Ford plans to build the new Delta at St. Thomas, Ont., and supply the whole North American market from this plant. The annual production target is 200,000 to 300,000 cars. Price will be pegged right at the \$2,000 mark.





Two new Rickman Métisse kits for motorcycle buffs

Because of the hard time U.S. motorbike fans have in getting some small items for English parts, Rickman's kits now come with everything. The Mark III kit (above, right) has 250 pieces from the frame down to little self-locking nuts to hold the dual air filters.

The bike is designed for use with a 650-cc. Triumph engine. The disk-brake and front-fork assembly at left can stop bikes doing 150 m.p.h. Brake/fork assembly and Mark III kit are sold by Steen's Inc., Box 2276, Alhambra, Calif. 91803, at \$597 each.



Stretch tester places car controls

GM engineers rigged this panel of retractable rulers for a study on how far drivers can reach for buttons, knobs, and switches. The panel can be studded with 35 simulated controls to help engineers place the real ones in the most convenient spots for drivers.



Torture track tests tires

These earthmover tires are being tested for cut resistance by running them over up-ended lengths of railroad track at Goodyear's San Angelo (Tex.) proving grounds. The track determines the toughness of different rubber compounds used for the huge tires.



Ford LTD, built on 121-inch wheelbase, will compete against Dodge Polara, Pontiac Catalina.



Mercury Marquis has 124-inch wheelbase, is aimed against Buick and Chrysler market.

Ford and Mercury Upgrade All Full-Size Cars for '69

From Falcon to Lincoln, Ford Motor is out to tempt you with new values in a realigned model range.

By JAN P. NORBYE / PS Automotive Editor and JIM DUNNE / PS Detroit Editor



Mercury Marauder is sporty coupe, shares the 121-inch wheelbase with the Ford line.



Monterey, lowest-price full-size Mercury, will rival Dodge Monaco and Pontiac Executive.

We told you they were going to stretch wheelbases, widen the tracks, do away with the front-door vent windows, introduce a new tailgate that can be opened with the window up or down, offer a couple of new engines, improve the impact absorption of the frames, and park the wipers off the windshield [PS; June, July].

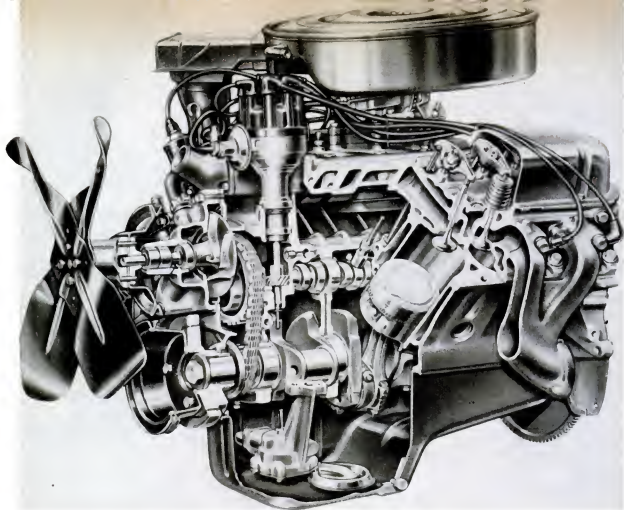
Now it's official. Now we can give you the precise details, and tell you the full story of the Ford, Mercury, and Lincoln model line-ups.

The full-size cars. This is where Ford has put most of its better ideas this year. The Custom and Galaxie have a

121-inch wheelbase, Mercury's new Monterey and Marquis have a 124-inch wheelbase. The sporty Marauder is built on the 121-inch wheelbase. Overall length has grown very slightly, since ease of parking is important. What's so good about a longer wheelbase? It gives a flatter ride and improved stability. It improves rear-seat space and comfort.

If you thought last year's Monterey was Mercury's answer to the Pontiac Catalina, you've got to look on the new Monterey as being in the Executive class. The top-of-the-line Marquis is aimed right at the Chrysler New Yorker, Oldsmobile 98, and Buick Electra.

Continued



New 351-cu.-in. engine will be the base-model V-8 for Ford Motor Co. intermediates and sporty com-

pacts (Torino, Fairlane, Mustang, Cougar, Montego, and Cyclone). Above: 250-hp. two-barrel version.

Montclair and Park Lane models, in case you were wondering, have been dropped. On all these full-size Ford and Mercury cars, the track is 63 inches in front and 64 inches in back, up one and two inches respectively from last year. What's so good about a wider track? It gives improved handling. That includes better cornering response, reduced sensitivity to changes in the road, and less risk of

the car turning over in an emergency.

Part of the upgrading process for '69 was a revision of the body mounts to minimize road noise and vibration. New weatherstripping provides tighter sealing against wind noise. The Mercury interiors are more luxurious than ever, but Ford has done something more: The instrument panel is just a small, contoured area in front of the driver, obviously in-



Mercury Cyclone instrument panel continues the tasteful '68 design, and adds a new steering wheel.

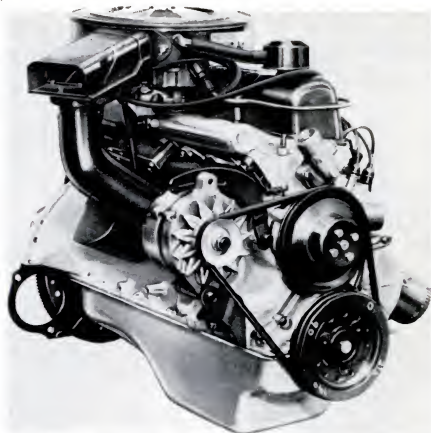


Ford Galaxie instruments are clustered in front of the driver and angled to his line of vision.

spired by aircraft design. The rest of the dash is a vast uncluttered padded panel with a glove box, swept forward in relation to the instrument cluster. All the '69 cars have a collapsible steering column, and the new steering wheels are attractive. Small controls are neatly recessed. The glove-box lock has a rotary catch that so engages the lock that the lid stays closed in case of impact. The push-button is recessed, and the hinges redesigned to break away on head impact against the panel.

New Ford engines. One is a 250-cu.-in. six; the other a 351-cu.-in. V-8 [PS, Apr.]. How new are they? Derived from successful production engines, they do not represent any engineering breakthrough. But Ford is staking a lot on them, for they're standard in the hot-selling intermediate lines, plus Mustang and Cougar.

The 250 six has no relationship to the 240, which continues as standard in the big Ford. That 240 originally was designed as a truck engine, and is both too long and too heavy to fit in lighter cars. The new 250 belongs in the family of the 144-, 170-, and 200-cu.-in. sixes, but is a new design in that it has its own block and head, crankshaft, front cover and ac-



New 250-cu.-in. six is a smooth, seven-bearing passenger-car engine that will give the intermediates a useful economy option.

cessory drive, pistons, connecting rods, and camshaft.

At the same time, the 200 has been improved, so that the 200 and the 250 are well-chosen stablemates:

	200	250
Bore x stroke.....	3.68 x 3.13.....	3.68 x 3.91
Comp. ratio	8.8:1	8.6:1
Power @ r.p.m.....	115 @ 3,800.....	155 @ 4,000
Torque @ r.p.m.....	190 @ 2,200.....	240 @ 2,400
Weight	389 lb.	419 lb.

Continued



Ford Country Squire shares the 121-inch wheelbase of the sedan. New features include concealed head-

lights and a two-way tailgate that can be opened as a door even with the window in up position.



Mustang Cobra-Jet 428 is top performer in the new line of cars. All-new Cougar is longer, heavier,

The new 351 V-8 has nothing to do with the old Y-block 352 (which has not been used in passenger cars for a few years but still powers Ford trucks). That old 352 is related to the 390, a heavy but tough workhorse of an engine. The new 351 is derived from the 221, 260, 289, 302 Fairlane/Mustang series, a lightweight high-performance engine of race-proved stamina. Two versions are offered, a two-barrel regular-fuel job, and a four-barrel high-compression setup:

	351 2-bbl.	351 4-bbl.
Bore x stroke.....	4.00 x 3.50.....	4.00 x 3.50
Comp. ratio	9.5:1	10.7:1
Power @ r.p.m.....	250 @ 4,600.....	290 @ 4,800
Torque @ r.p.m.....	355 @ 2,600.....	385 @ 3,200

Both the new 250 six and the 351 V-8 will have the IMCO system of exhaust-emission control rather than the Thermactor air-injection system with a separate pump and a lot of extra hardware.

Other engine changes. Some engines have been modified; others have been adapted to vehicles in which they were not available before. The 429-cu.-in. Thunderbird V-8 belongs in both categories. The cylinder heads have been reworked to give canted intake valves for better breathing. The round cross section of each port is intended to give an unrestricted air flow into the combustion chamber and therefore better cylinder filling. A Thunderbird exclusive until now, the 429 V-8 becomes the standard Marauder engine for '69, and will be optional in all big Ford and Mercury models.

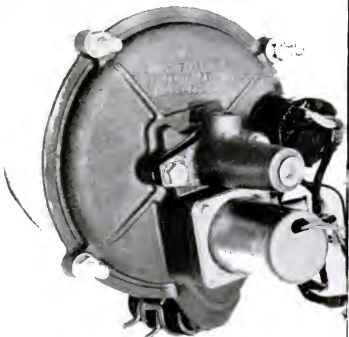
Like the new 351 V-8, the 429 comes with either a two- or a four-barrel carburetor.

Both require premium fuel, since they have the same 10.5:1 compression ratio. The two-barrel unit delivers 340 hp. at 4,400 r.p.m.; the four-barrel version 360 hp. at 4,600 r.p.m.

The 390 V-8 continues as the mainstay of the big Fords and Mercurys. It has a new camshaft, valve springs, and valve-stem seals, plus a revised intake manifold. It delivers 265 hp. at 4,400 r.p.m. with a two-barrel carburetor and 330 hp. at 4,600 r.p.m. with a four-barrel carb.

The 428-cu.-in. V-8 is the hot one this year (the 427 used in the NASCAR stockers is a limited-production option). Cobra-Jet 428s are optional in the Mustang, Cougar, Fairlane, and Cyclone, delivering 335 hp. at 5,600 r.p.m. with a compression ratio of 10.5:1 and a four-barrel carburetor.

Antiskid brakes. Ford announced earlier this summer that an antiskid brake system would become available on the Thunderbird, but after much soul-searching, Ford Division at the last minute decided against it. It's only for the Continental Mark III that the Kelsey-Hayes antiskid brake system has become a regular production option. Why? Our guess is that



Antiskid control unit receives signals from computer, gives instructions to brake pressure valve.



more luxurious than ever.

Two-door Cyclone CJ 428 handles as well as it accelerates.

Ford wants to limit the number of vehicles so equipped, to keep an effective watch on their behavior in the field. Let's make two points quite clear:

- The antiskid feature refers to wheel locking under braking only, and will not protect the car from sideways skidding.

- The present system is applied to the rear wheels only and will not keep the front wheels from locking under braking.

Basically, the Kelsey-Hayes system is intended to prevent an unskilled driver from losing control as a result of wheel skidding in a panic stop. The system is most effective on slippery surfaces such as ice or wet pavement. Each rear wheel has a sensor that sends signals to a small computer whenever wheel rotation stops. The computer then cuts brake-line pressure to the wheel in question, and the wheel gets going again. Then brake force is reapplied, and the cycle repeated, up to five times per second.

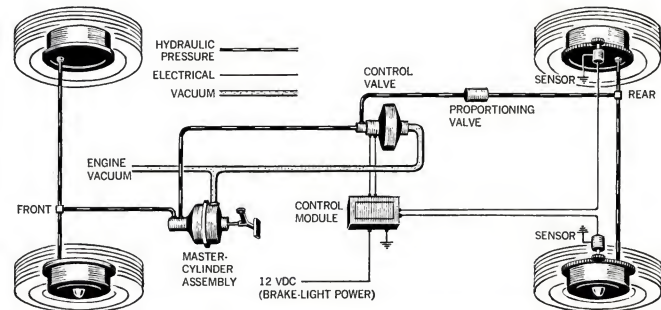
Is it an important safety option? Factory people feel the Mark III driver will use

the antiskid mechanism only three or four times a year, during heavy rain or on ice. In such conditions, the antiskid-brake car will stop in 20 to 40 percent shorter distance than a Mark III without the device.

We tested a Mark III equipped with antiskid brakes on gravel roads in dry weather. On straight roadways, the car invariably pulled up in a straight line.

Then we took a curve at 50 m.p.h. and slammed on the brakes in the middle of the turn. The front wheels locked and skidded outwards, while the rear wheels just trailed behind as obediently as in a straight-line stop. Without the antiskid device, there would have been a risk of spinning completely around.

There can be no doubt that this system is a valuable safety aid, especially to the unskilled driver. The price? It will be about \$100 extra on top of the Mark III's \$7,500 basic price. In volume production, Kelsey-Hayes could probably get the cost down to \$50. 23



Antiskid brake system is Mark III option, works on rear wheels only. Each wheel has a speed sensor,

but control valve for pressure operates on both rear wheels, freeing or applying brakes on both together.

Our upcoming space flights will build a

STAIRWAY TO THE MOON

Program of Manned Apollo Missions



MISSION C. First manned Apollo mission. Earth-orbiting flight (low orbit).

MISSION D. First manned Saturn V mission. Earth-orbiting flight (low orbit).

MISSION E. Rehearsal of moon mission. Earth-orbiting flight (high orbit).

MISSION F. Flight around moon and descent to within 10 miles of lunar surface.

MISSION G. THE LUNAR LANDING.

Vehicles. Mission C: Up-rated Saturn I; CSM. All other missions: Saturn V; CSM and LM.

Crew. Three, on each mission. They will be designated "Commander," "Command Module Pilot," and "Lunar Module Pilot." Mission G's Commander and LM Pilot will land on the moon, with the LM, while the CM pilot remains in the moon-orbiting CSM.

Hand-held 4½-pound TV camera, developed by RCA and due to go aloft on first Apollo manned flight, will transmit first live pictures of orbiting American astronauts and views seen from their craft.



Here are the steps by which our manned Apollo missions will lead to landing men on the moon

By DR. WERNHER VON BRAUN

Director of NASA's George C. Marshall Space Flight Center, Huntsville, Ala

When three astronauts in a cone-shaped Command Module are rocketed into orbit a few weeks hence, our Apollo lunar-landing program will be on the final straightaway stretch.

It has come around the corner with successful unmanned flight tests of its Saturn V rocket and all spacecraft modules. What we call Mission A was the demonstration by our first two unmanned Saturn V flights of the soundness of the launch vehicles and the adequacy of the Apollo heat shield. Mission B was the launch last January of an unmanned Lunar Module (LM) by an Up-rated Saturn I.

Yet, even now, it would be reckless and unrealistic simply to assemble the whole stack, put a crew aboard, and blast off without further ado for a lunar landing. First, manned partial-mission flights must try out the spacecraft, their subsystems, and procedures for flying them, in the space environment for which they were designed.

First manned Apollo. Next step on the remaining "stairway to the moon" will be Mission C—the initial manned flight of the Apollo Command and Service Module (CSM), and our first manned space flight since the last Gemini nearly two years ago. It will be carried out by astronauts Schirra, Eisele, and Cunningham in the soon-to-be-launched Apollo 7.

Mission C will include quite a number

MOON

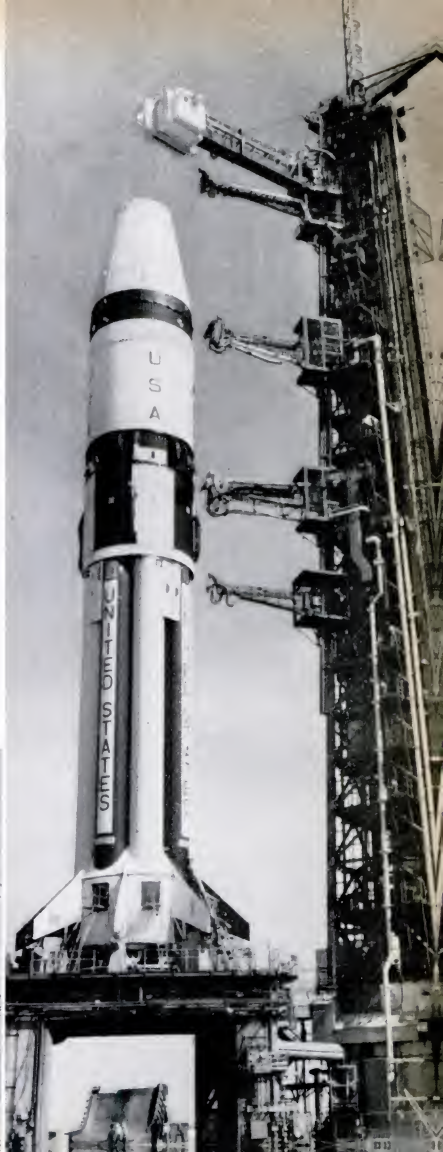
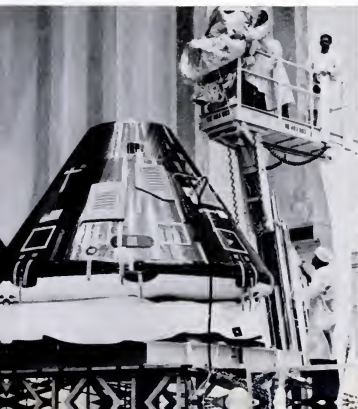
of "firsts." This will be the debut in manned flight of the new Apollo Command Module, redesigned and drastically fireproofed. The flight will introduce the newly adopted safeguard of substituting a nitrogen-oxygen mixture, as a prelaunch cabin atmosphere, for the 16-pound-pressure pure oxygen of the past. A hand-held RCA TV camera is expected to be carried aboard, providing a novelty for the public—live TV views of our astronauts in space.

Boosted by a two-stage Uprated Saturn I, Mission C will be a low earth-orbiting flight lasting nearly 11 days. It will not carry a moon-landing Lunar Module, but will serve simply to try out all systems of the CSM—the Command Module, and the attached Service Module that provides propulsion and other needs.

During Mission C the CSM's orbit will be varied from a nearly circular one,

Continued

Apollo 7's Command Module, below, is readied at Cape Kennedy to go atop Uprated Saturn I rocket at right—and carry three astronauts into earth orbit on Mission C, first of coming Apollo manned flights.



averaging 155 statute miles high, to an elliptical one ranging up to 270-mile height. To simulate a rendezvous with a Lunar Module, the crew will try to rendezvous from 170-mile distance with the launch rocket's orbiting second stage.

First manned Saturn V. Apollo 8 and its 10-day Mission D, coming next, will undoubtedly be the most complex manned space flight ever attempted. It will be the first manned trial of the three-stage Saturn V—which, with both CSM and LM in place, will tower 363 feet high. Although Mission D will get no farther from earth than about 160 miles, it will exercise the entire stack of equipment required for a flight to the lunar surface. Here are highlights of its plans:

First day: The launch puts the third stage and spacecraft in a 119-mile circular orbit. The CSM separates, turns squarely around, and extracts the LM from Saturn V's third stage. The combined spacecraft climbs to a higher elliptical orbit under Service Module power. Meanwhile a second and third burn of the unmanned Saturn V third stage propel it out of the earth's gravitational field, as if bound for the moon.

Second day: The spacecraft cluster simulates the deboost into lunar orbit by firing the Service Module propulsion system. The last of three burns leaves the craft in circular 154-mile orbit.

Third day: The LM crew of two crawl through a tunnel from the Command Module (CM) to the LM for a complete LM checkout, including short burns of its descent stage under automatic and manual control.

Fourth day: Now comes a "space walk." The LM Pilot, with a self-contained life-support pack, proves it feasible to go from the LM back to the CM outside the vehicles. (In a lunar flight the LM crew, returning from the moon to the CSM, would fall back on this plan if damage from a hard docking prevented use of the crawl tunnel.)

Fifth day: The crew reenter the LM and it separates from the CSM. The

LM crew set up (but do not execute) rendezvous maneuvers with the CSM, using the descent stage's propulsion system. Then the descent stage is jettisoned. The LM's ascent stage, using only its reaction control system for propulsion, effects a rendezvous with the CSM, and the LM crew return to the Command Module.

Sixth to 10th day: The crew perform navigation exercises and various experiments—and retry their earlier tasks, to practice and improve the technique of these procedures.

Rehearsal for moon flight. Nine-day Mission E in Apollo 9, taking its crew 4,600 miles from earth, will rehearse a lunar flight's principal maneuvers.

As if to start the spacecraft on a lunar trajectory, Saturn V's third stage will have a second burn—but of half the duration for a flight to the moon, so that it actually puts the spacecraft into an elongated elliptical earth orbit with a high point of about 4,600 miles. The CSM will turn around, dock to the LM, and extract it, as in a lunar flight. A short burn of the Service Module engine will simulate a midcourse correction; and a long burn, braking for insertion in lunar orbit. This and a lunar-orbit "fine-trimming" maneuver will actually bring the spacecraft down to a circular 173-mile earth orbit.

Entering the LM, the Commander and LM Pilot will fire its descent engine to simulate an emergency CSM/LM return to the earth under LM power. Freeing the LM, they will enact a descent toward the moon, an "abort," and a return to the CSM, which they will reenter. Detaching the LM ascent stage, they will simulate a CSM rescue rendezvous with an incapacitated ascent stage. Lastly, a Service Module burn will represent a normal earthward maneuver from lunar orbit. From a resulting elliptical earth orbit of 104 to 230 miles, the CSM will de-orbit and splash on the ninth day.

Flight around the moon. Newly announced by NASA as a tentative next

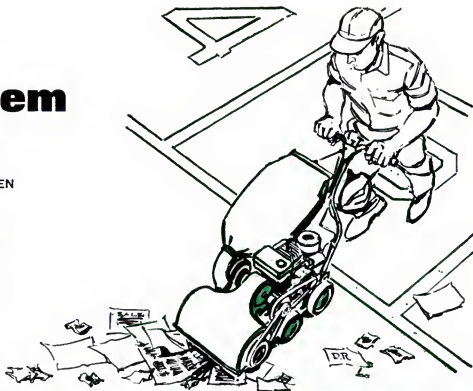


Coming manned missions, says Dr. von Braun, will build up experience needed for final assault on moon.

'I'd like to see them make...'

DRAWINGS BY DANA RASMUSSEN

ing-size vacuum cleaners that would shred papers they sucked up. Great for parking lots, shopping malls, and such.—K. C. Rutherford, Lincoln, Nebr.



ame-marking pellets in shotgun shells. Why not shells with different-colored pellets so a group of hunters could tell who bags the bird? —J. C. P. Miscavish, Los Angeles, Calif.



Cameras with luminous markings at all adjustment areas. Brightness should be enough to provide visibility for changing settings in a dim light.—Greg Swanson, Seattle, Wash.



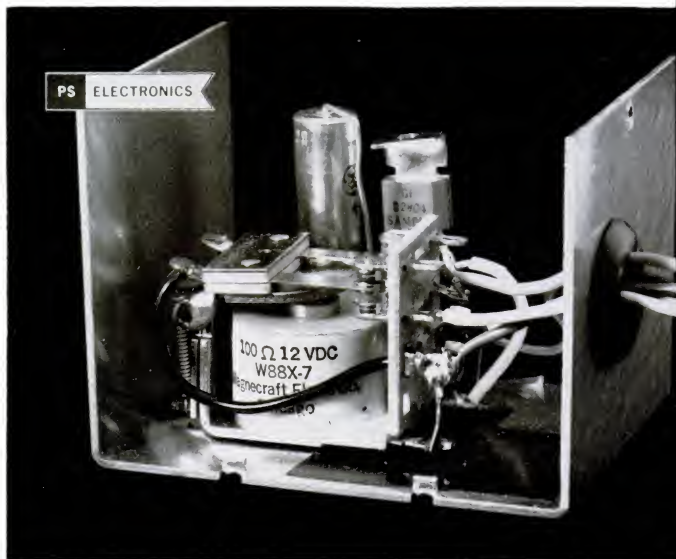
xtendable trailer lights built into towing vehicles to eliminate the nuisance of rewiring when a towed or towing vehicle is changed. —J. H. Schmidt, Pollock Pines, Calif.



Double-duty hand trucks with a collapsible basket that would open out to make a shopping cart. The handle would telescope to fit a car trunk.—J. Botwin, Brooklyn, N.Y.

everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay \$5 for each one published. Please use Government postcards

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Time-Delay Light Switch

Forget to turn off your lights? With this easy-to-build time-delay switch, you'll never get stuck with a dead battery. It shuts them off for you

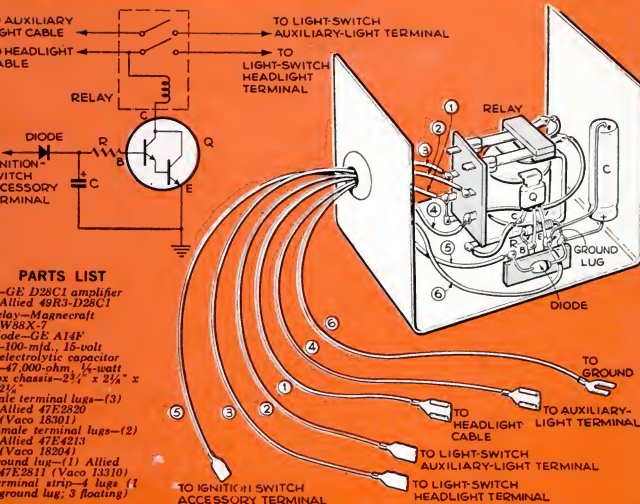
By SAM SHATAVSKY / PS Electronics Editor

There are few things more frustrating than being stranded with a dead battery because you forgot to turn off your car lights. But this problem need never annoy you again, thanks to an ingenious time-delay switch that automatically shuts off the lights soon after you leave your parked car.

The switch is housed in a small, easy-to-build electronic control box that you hook up to your car's lighting circuit.

Constructing the control box. Assembly is simple. The unit consists of the control relay, a tiny prepackaged GE dual-stage transistor-amplifier, diode, resistor, and capacitor. Six cables, with male and female auto-wiring lugs, connect the unit to a car's wiring system. After assembling the box, mount it in a convenient place under the instrument panel.

Since you must rewire your car's lighting circuits to accommodate the control box, a clear understanding of the arrangement of these circuits is essential. Ford, GM, Chrysler, and most other car makers have two main lighting circuits: headlight, protected by a circuit breaker; and auxiliary (or parking, stop, dome, and in-



Saves Your Car Battery

strument) lights, protected by fuses.

Both circuits run to the instrument-panel light switch. Each pair of the single-pole/double-throw relay contacts in the control unit are put in series with these two circuits. To rewire for the control box, simply disconnect the two lines from the terminals in back of the light switch and replace them with the appropriate relay cables from the control box. Then mate the loose light-switch cables to the corresponding cables in the control unit.

To complete the installation, make a connection from the control-box cable to the accessory terminal in back of the ignition switch. (This supplies 12 volts DC to keep the transistor switching amplifier on.) Join the ground line of the control box to a suitable ground point

on the chassis. All the steps for the installation are shown in the accompanying diagrams.

Words of caution. Be sure to remove the ground terminal of the battery before installing the control box. Otherwise, there might be an accidental short, which could be the cause of a damaging welding or fire arc.

Moreover, before you begin diddling with *any* of the circuitry, carefully study a diagram of the wiring in the car to familiarize yourself with the color code of the cables. Each manufacturer has a set code and maintains it yearly for the new models. Here are some of the color codes:

- Chevrolet: headlight cable, red; auxiliary-light cable, orange.

Continued

● Ford: headlight cable, black-orange stripe; auxiliary-light cable, green-yellow stripe.

● Plymouth: headlight cable, black with tracer; auxiliary-light cable, pink.

(For other makes, check your car's shop manual.)

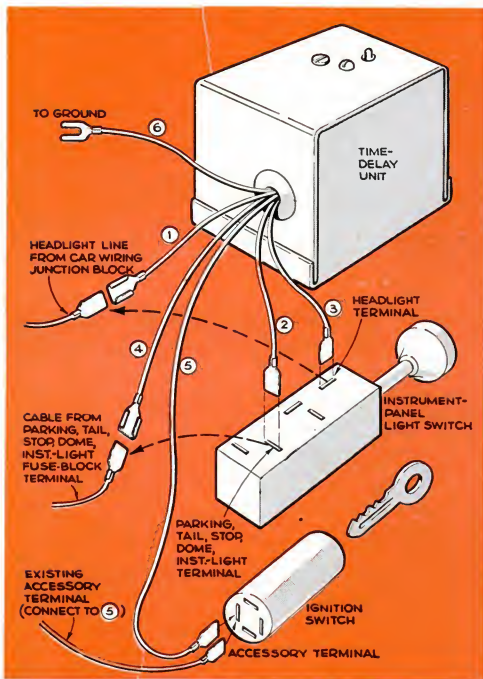
How it works. A resistor-capacitor circuit is responsible for the system's delayed switch-off time. The time delay is made possible by rewiring the head, parking, tail, dome, and accessory lights through a relay that is part of the RC control circuit. The relay connects the

necessary road and accessory lights for normal driving. But when you turn off the ignition, the relay stays on for the set time (about two minutes) of the RC circuit and then lets go, shutting off your lights automatically. To use the lights while the car is parked, you just turn the key to the accessory position.

The control box has an added attraction: It can light the way to the front door if you purposely leave the headlights on after parking the car. The time-delay switch will shut them off after giving you time to get into the house.

On the debit side, you won't have interior lighting when entering your car in the dark, since the relay takes in the courtesy lights. If this strikes you as too inconvenient, simply ignore the courtesy-light cable when you rewire the circuits through the control box. But think twice before you decide to leave the courtesy lights out of the system. It's easy not to notice them when you get out of your car (who knows whether they go off once the door closes?) By including them in the system, you put them under the protection of our battery saver.

Unless you're one of the fortunate few blessed with a faultless memory—and most of us aren't—then this gadget is for you. The time spent building and installing it will be richly rewarded by the money saved (fewer batteries to replace, battery-jumping fees and towing costs), not to mention freedom from the dead-battery blues.



The automatic time-delay switch works by way of a relay in the electronic control box, through which the lines to the headlights and ignition switches are rewired. For installation, remove the cables from the switch terminals and reconnect them to the lines in the control box, as shown in diagram.



Combination home-video and four-track recorder uses 1/4-inch tape

You can record and play back live scenes, TV programs, and standard four-track stereo music with this new Roberts Model 1000 recorder. With 1/4-inch tape, the machine

operates at less cost than earlier models using expensive 1/2- to two-inch tape. It runs at 11 1/4 inches per second for video, 3 3/4-7 1/2 speeds for audio. Cost: Under \$1,000.

Strobe light for unusual psychedelic effects

This quick-flashing strobe light is just the thing for creating dramatic light sensations. Because it's electronic, it has shorter flash duration than mechanical strobes. And it adjusts to produce flash rates from one to 10 per second, so you can create slow-motion effects—great for parties, night clubs, dances, and exhibitions. The unit is also practical for freezing the motion of moving machinery for photography or to check for defects in any of the working parts while the equipment is in operation. The million-flash xenon lamp has a 6 1/2 inch reflector; the case is solid walnut, with a handle for easy carrying. The unit operates on household AC, and weighs 3 1/2 pounds. It sells for \$79.95 from Edmund Scientific, Barrington, N. J.

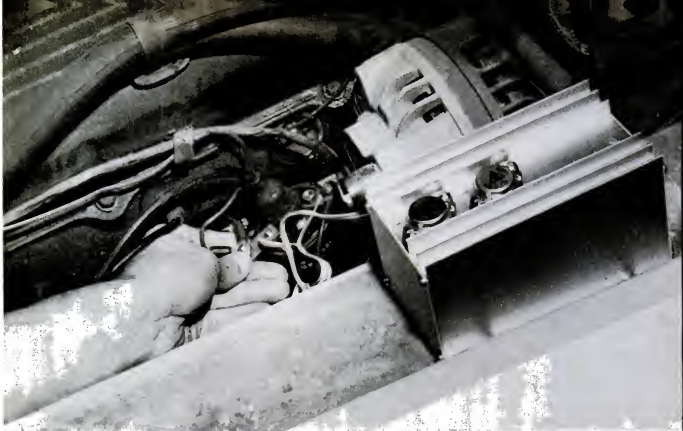


New rechargeable sealed power pack for portable TV

You can run your portable TV set for 640 hours, with recharge after every four hours, with this six-cell, 12-volt DC battery. Its capacity is four ampere-hours. A miniature

version of an automobile battery, it never needs water because it's completely sealed in a tough impact-resistant case. The EMF-5 from Exide sells for \$18.95.





PERSONAL-USE REPORT:

Kit-Built C-D Ignition Boost

50,000 miles between plug changes, a smoother-running engine, greater gas mileage, increased acceleration—all or some of these are possible with capacitive-discharge ignition in your car

By SAM SHATAVSKY/PS Electronics Editor

Is capacitive-discharge ignition for your car all it's cracked up to be? Will it give you a smoother-running engine? What about increased gas mileage, hotter acceleration, more miles between tune-ups? I got the chance to look for answers to these questions by building and testing Allied Radio's new C-D model, the KG-372 Knight-Kit (\$29.95). My findings: Yes—and no.

Yes, my '65 Dodge Dart idles much more smoothly. No, I could measure no improvement in gas mileage or acceleration. But you have to bear in mind exactly what benefits C-D ignition can give—as well as what it cannot do.

The benefits. Because the system develops about four times the spark-gap energy of conventional ignition, it's a natural for

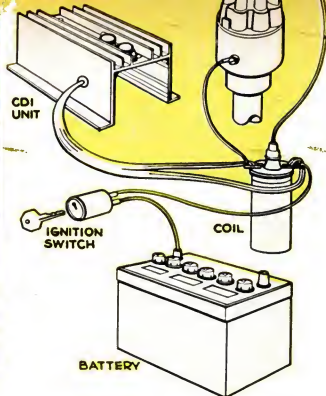
overcoming misfiring due to high-voltage requirements caused by excessive plug gaps and high compression pressures. Misfiring is usually caused by plug-gap growth and high voltage leakage to ground across the ceramic nose of the spark plug. Of course, if misfiring conditions don't exist, C-D will have no noticeable effect.

My car has no misfiring condition, so I observed no gas mileage and pickup improvement. However, for ordinary spark-plug wear and aging that affect performance at all speeds, C-D's high voltage compensates for gap wear, extending plug life to as much as 50,000 miles.

Another benefit comes from its instantaneous spark-energy release. Because of this it will fire a fouled plug that a conventional ignition system can't.



To build the C-D ignition system, you assemble two interconnected circuit boards that slip into an aluminum housing. Wiring this to your car's ignition system is simple. Just replace the regular ignition-coil leads with two cables from the C-D system. The unit mounts under the hood with self-tapping screws.



PS ELECTRONICS

Your Car's Performance

How it works. Its electronic DC-to-DC converter boosts the battery's 12 volts to 400 volts DC. This voltage, stored in a capacitor, is discharged through your regular ignition coil by a triggered silicon-controlled rectifier. Special circuitry also prevents accidental triggering and problems caused by point bounce at high engine r.p.m. Under these circuit provisions, successful ignition is possible even with the distributor points in a degraded condition. Without C-D, the poor points would not allow operation of a conventional ignition system.

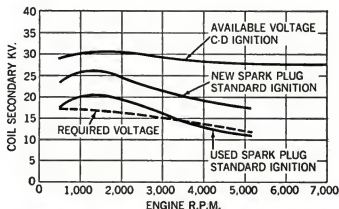
Building it. This was no more difficult than putting together a simple hi-fi kit. It took me short of six hours to assemble the two interconnected printed-circuit boards, slip them into their aluminum box, and screw the box to a fender wall close to the car's ignition coil. Installation takes only minutes—remove the ignition and distributor leads from the coil and replace them with the two leads from the C-D box.

Testing it out. My Dart started with immediately noticeable improvement in engine idling. That annoying unbalanced

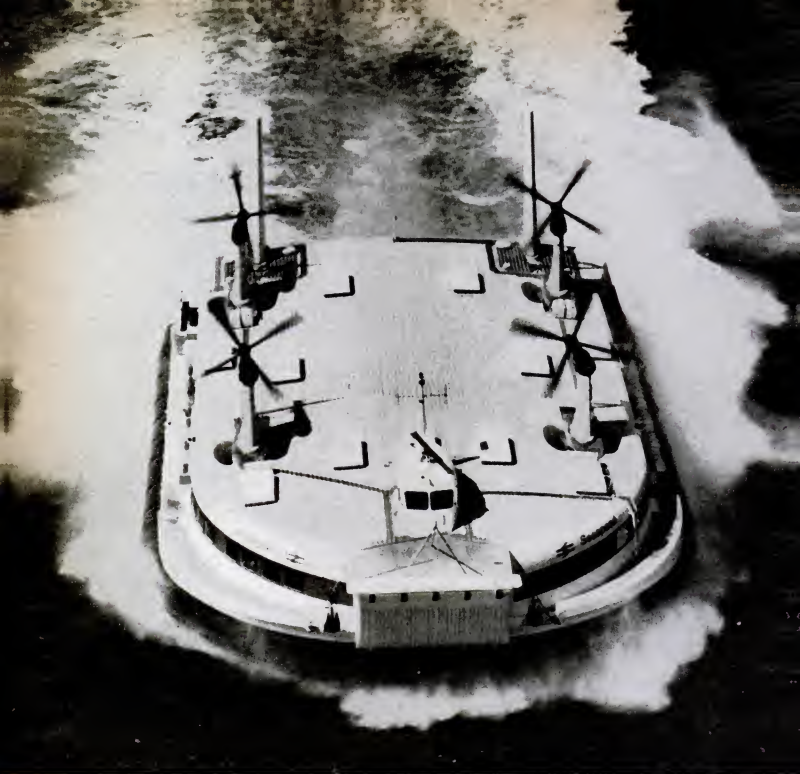
rocking of an engine needing a tune-up was gone. Yet my spark plugs had over 20,000 miles on them and the car hadn't been tuned for as many miles.

Out on the road, I ran 90 miles with, and 90 without, C-D. Results: 20 m.p.g. either way. On acceleration tests: 0-60 m.p.h. and 25-70 m.p.h.—again no change.

My tests were made during the summer, but I'm looking forward to an easy winter: C-D ignition is noted for aiding cold starts in freezing weather.



Curves show the comparative effect of capacitive-discharge and standard ignition on the useful life of spark plugs. The doubled C-D voltage maintains the effectiveness of plugs far longer.



Getting up speed, giant SR.N4 lifts off water. Skirt balloons around craft and escaping air from lift

Cruising at 60 m.p.h., big air-cushion vehicle leaves a flat wake, no wash. Skirt is eight feet high when inflated, as here. Control cab is on top. High speed necessitates constant radar surveillance.

fans creates spray—which doesn't reach the passenger-cabin windows, and at speed is left behind.

Tail assembly (fin and rudder) dwarfs author Scott, peering at one of 19-foot-diameter props. Tail and propeller pylon swivel hydraulically. Hydraulic pump is powered from gearbox in engine room below.



Across the English Channel in 35 minutes:

Aboard the World's Largest Hovercraft

Four times the size of any such craft ever built, the SR.N4 carries 254 passengers, 30 cars

By **DAVID SCOTT/PS European Editor**

It is like being in a DC-3 just before touchdown. But instead of a runway, the choppy water of the English Channel is streaking past at 70 m.p.h. some 15 feet below me.

Up front in the passenger cabin where I am sitting, there is a clear view ahead. The drone of machinery could be from piston engines out on the wings, but I feel no vibration. Only the jiggly movement, like riding in a firmly sprung sports car, tells me that I'm not flying but skimming over the wave crests on an eight-foot-thick cushion of air.

This is the world's biggest air-cushion vehicle (ACV)—four times the size of

any ever built before. Over 130 feet long and 70 feet wide, the giant SR.N4 hovercraft can carry 254 passengers and 30 cars. In August, about the time this magazine comes out, it will start regular service across the Channel between Dover and Boulogne, making the 30-mile run in 35 minutes at an *average* speed of 52 m.p.h. That's barely a third of the time of the ferry boat, and speedy roll-on and roll-off loading and unloading of cars on dry land cut the turn-around to a mere 20 minutes.

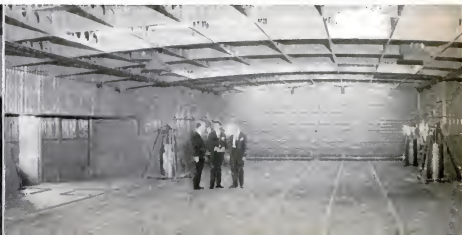
There are six scheduled crossings a day in summer, two in winter. Fares are a shade above the ferry: about \$8.25 for passengers and from \$10.40 to \$29 for cars according to length.

Shakedown tests. Aboard the SR.N4 for one of the shake-down sorties before the service began, I saw what this amazing machine can do. First came a simulated engine failure at speed. The test crew gunned the 165-ton craft up to around 60 m.p.h., then cut two of the four engines that drive the props and lift fans.

Continued

Quadrant-shaped compartment in bow is one of six passenger areas, with a total of 254 seats. Large windows provide a panoramic view. Air-conditioning unit is on the ceiling. That's Scott in the seat.

Vast hold of SR.N4 has space for 30 cars. Loading doors in stern are 31 feet wide. Hydraulic jacks visible at sides can lift the hull over eight feet for maintenance work on skirts and underside.





The air cushion collapsed almost immediately and I lurched forward in my seat as the great hulk dropped on the water in a white cloud of spray. In just five seconds we were drifting like a becalmed sailboat. It was a sudden but safe stop, and for emergency braking no ship could touch it.

Watching this jumbo get back up on its cushion was fascinating. As the dead engines were revved up again, the neoprene-fabric skirt ballooned out of the water all around us like a great black sausage. A necklace of bubbles spluttered from the rim, and with the lift fans building up pressure the skirt slowly disappeared, tucking away under the sides of the craft.

The sea dropped eerily away as the floating hull rose majestically a full eight feet (the height of the inflated skirt) above the surface. Once again we were enveloped in a thick mist caused by blow-by from under the skirt, but in a moment the SR.N4 was gliding forward, leaving behind its self-made plumes of fog.

In calm water: 84 m.p.h. Acceleration was swift, as there is only inertia and wind resistance to overcome, no water drag. Soon we were up to the normal 60-m.p.h. cruising, and beyond it to the

70-m.p.h. peak for the day. Incredible for a "surface" vessel? This big fellow had logged an actual 84 m.p.h. in calm water on an earlier sortie, the commander told me.

Then we went into a crabbing skid on a sweeping turn to check handling and stability. We hurtled nearly broadside, but stayed flat as a billiard table on wheels. You couldn't tell what was happening without looking down at the water rushing under instead of along the side, or at the wake of flattened waves trailing off from one flank.

Out in the open sea we hit some pretty rough water, but there was none of the pitching or rolling you'd get with an ordinary ship caught in the swells. And it was the same jiggly ride as we glided over the peaks. This boat takes waves up to 12-footers on an even keel.

Now we headed back to base, and the slow-down as we approached the shore was sweet and gentle. Props were reverse-pitched for controlled deceleration to the water's edge, then thrust ahead again for the climb up the concrete ramp onto the parking apron.

It's like a plane. The SR.N4 performs more like a plane than a boat, and it's built like one, too. You sense this from the aircraft-type toilet cubicle, and the



A boon to bad sailors, it rides level over waves up to 12 feet high—the English Channel's worst

SR.N4 climbs waterfront concrete ramp at Dover hoverport on its way to the parking apron (foreground). Craft crosses the English Channel six times a day in summer, and is scheduled for two crossings a day in winter. Drive-on/drive-off loading and unloading of cars make possible a turn-around time of 20 minutes at each end of the 35-minute trip. The service is operated by Seaspeed, a subsidiary of British Rail.

mere Mach 0.6 to minimize the external racket. From outside, the SR.N4 just hisses by.

Props (as well as fans) run at a constant speed, and thrust is regulated by varying the blade pitch. They are mounted on swiveling pylons, so thrust can be vectored for yawing movements.

Fans are 11½ feet in diameter, and blast out air through rectangular plenum chambers under the raised passenger cabins on each side of the hull. These feed the voluminous air cushions contained by the skirt, where pressure is a gentle 0.4 pounds per square inch.

Steering the SR.N4. The three-man crew is housed in a little cabin perched on the roof. Although the cockpit is equipped and instrumented like a jet airliner, there are only three main controls. The rudder bar aims the pylons differentially for tight turns at speed. So for a right-hand turn, the front two pylons swivel clockwise to head the bow in a new direction, while the rear pair swing counterclockwise together with the rudders to push the stern around.

The control wheel moves the pylons and rudders in unison to produce a side force for crabbing maneuvers or to correct for crosswinds. Then fore and aft movement of the wheel alters the pitch of all the prop blades collectively between full forward and reverse thrust.

Built by the British Hovercraft Corp. at a cost of \$4.2 million, the first SR.N4 is pioneering a new era of cushion-borne mass travel on the open sea. It has a 140-mile range over waves up to 12 feet high, the worst encountered in the English Channel, and the level ride is a boon to bad sailors.

Three more of these remarkable craft are already under construction, all earmarked for the England-France service. Next spring two will start up between Ramsgate and Calais, and in 1971 one will go on the Weymouth-Cherbourg run.

Seaspeed, a subsidiary of British Rail, operates the service.

How does this quartet of giant hovercraft affect the Channel Tunnel project? They could easily kill it. D E

faint whiffs of jet fuel when the engines are idling. Nine-tenths of the machine is made from light alloy to keep down the air-supported weight.

But it's a real hybrid. Passenger cabins are spacious, and outer ones are glassed in by picture windows. The vast car deck has full-width doors at the stern for drive-on loading, and an integral drive-off ramp in the bow.

The main structure is a mighty raft assembled from 400 box-like sections divided into 24 groups of watertight compartments. It floats the craft as a surface vessel, and the safety margin is a 250-percent buoyancy reserve. Underneath are five two-foot-high parking stilts to support the stationary hull on land, and six hydraulic jacks that can raise it over eight feet for maintenance work on the skirt and underside.

Turboprop muscle. Power is from four 3,400-hp. turboprop engines paired in two tail-end compartments. Each drives one of the propellers coupled individually to the four lift fans directly below through a fixed-ratio gearbox. Fat 60-foot-long shafts carry the torque to the forward propellers and fans.

The four-bladed props are 19½ feet in diameter, and specially designed so the noise-generating tip speed is kept to a

New DYNAPLANE: twice the speed on half

The Navy's sweptback, stepped hull may make a family outboard as speedy as a hydrofoil

By WALLACE CLOUD

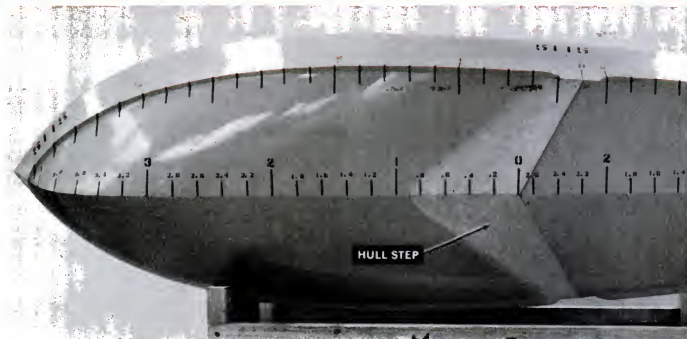
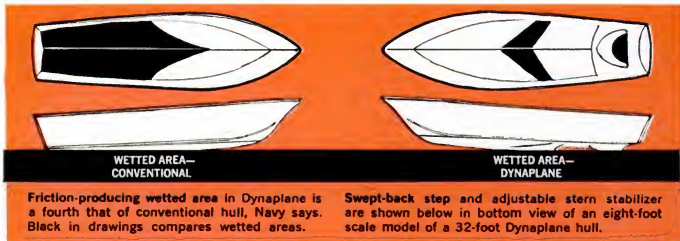
The Navy is working on a deceptively simple boat design that puts planing hulls—much like the family outboard—in a class with hydrofoils and other exotic high-speed craft.

The design, called Dynaplane, consists essentially of a hull with a step in it.

Nothing new about that! But the step is so thin that it almost isn't there—only $\frac{1}{8}$ inch deep on the tank-tested eight-foot model. On a 32-foot boat the step would be $\frac{1}{2}$ inch deep.

Yet so efficient is the step that it dramatically reduces wetted area, and thus friction. Designers at the Naval Ship Research and Development Center (NS-RDC) in Washington claim a 50-percent reduction in drag over conventional planing hulls.

Dynaplane can attain a given planing speed on half the fuel and horsepower a regular high-speed craft would need. This means a 50-percent saving in both engine cost and fuel rate, together with



he fuel

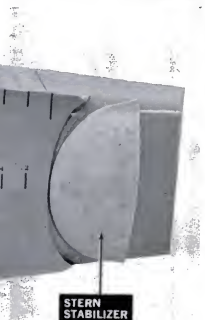
100-percent increase in range at top speed. The step is so thin that low-speed efficiency is virtually unaffected. It may be possible, then, to build sporty boats and small ships that can go 40-50 m.p.h., and handle safely in rough water.

The secret? Chief designer Eugene Clement explained that the hull step is swept back, like the swept wings of a jet plane, and also has a carefully cambered surface.

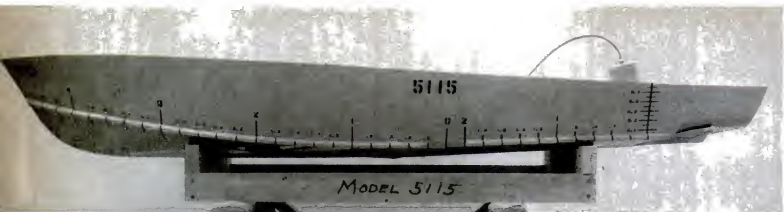
In most stepped hulls, he noted, the step cuts straight across the hull. The water separating from the aft edge of the step then converges to form a jet, angled downward, which strikes the hull behind the step. This increases water drag, partially defeating the purpose of the step, unless the step is deep.

The swept edge, explained

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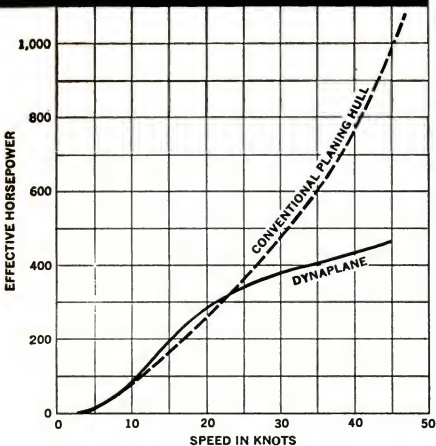


Increasing water separation from hull as Dynaplane accelerates is shown in the photo sequence above. As the scale model is towed faster, bow lifts and water separation (bubbles) behind the step increases. Once the model hull reaches a scale speed of 45 m.p.h., it is supported only by the step and part of the stern stabilizer. The photos were taken underwater during the tests at the Naval Ship Research and Development Center.



A side view of the scale-model Dynaplane shows how thin the cambered midship step is. You can hardly see it. But it's there, $\frac{1}{8}$ inch thick, on the underside, just forward of the model number.

POWER NEEDED VS. SPEED



plained Clement, eliminates the converging step and is thin. A cambered surface (curving up at the forward edge, down at the aft) produces maximum lift.

At high speeds, Dynaplane's midship step supports 90 percent of the boat's weight. The remainder is carried by a stern planing surface—an adjustable stabilizer developed by NSRDC engineer John Plum.

Powered by an air piston from inside the hull, the hinged stabilizer controls the trim angle of the craft for minimum drag or to cope with wave action. In head seas, for example, the stabilizer's angle of attack is increased, lowering the bow so it knifes into the waves and doesn't get pushed around. In a following sea, the stabilizer is retracted to raise the bow so the boat can climb over waves.

The designers think Dynaplane is suited to four types of naval craft: patrol boats, landing craft, high-speed personnel transports, and air-propeller-driven swamp boats. A fast landing craft is in the Navy's plans, but there has been no decision yet by the Pentagon on whether it will be built.

What about pleasure craft? Several pleasure-craft builders have inquired about Dynaplane, Clement says, so the design very likely will reach the civilian market. Can a boat owner adapt the idea to his own hull by trial and error? Clement says it would be difficult to reach the correct configuration, which depends on the boat's weight and speed.

However, a booklet explaining how to calculate the shape and dimensions of the midship step will reportedly be available soon. Those interested may inquire about it at the NSRDC Public Affairs Office, Washington, D.C. 20007. **ES**

TO REMOVE SECTION for loose-leaf binding,
open magazine wide at this page, rest it on table,
run your thumb firmly along center fold.
Then pull out the sheets gently, one at a time.

PS EXTRA! Special In-Depth Report Your TV Antenna May Be Out-of-Date!

Your TV antenna can make or break your set's performance. Here are the facts—engineering, performance, models, prices, installation advice—you need to update

By SAM SHATAVSKY
PS Electronics Editor

The TV signals over your home aren't what they were five years ago. With color and UHF-channel buildup putting greater demands on antenna performance, reassessment of your rooftop signal pickup system is in order. It can bring you sharper, cleaner pictures, clear up color problems, and bring in UHF channels you never saw before. A whole new world of viewing awaits you.

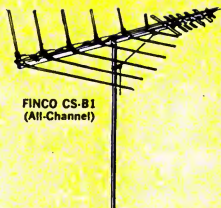
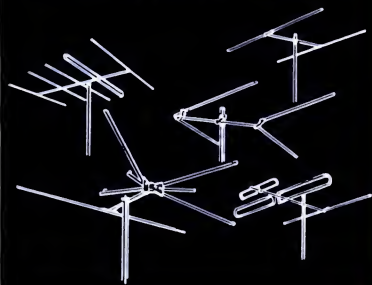
For this report, I surveyed 18 an-

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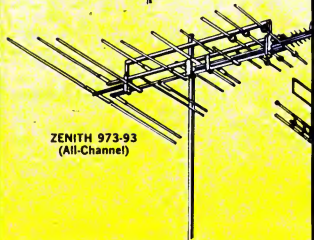


Antennas—old and new

Designs have come a long way from the early models. The old in-line, conical, V-beam types (below) have given way to updated, high-gain multi-element designs. Meeting the need for metropolitan to long-distance fringe service, the new models offer improvements in gain, directivity, and uniformity over a broader channel spectrum. Models (right) represent a sample of modern antennas for U-V (all-channel), VHF, and UHF use. A chart on another page includes 208 models from 18 manufacturers. They represent what's available in antenna design.



FINCO CS-B1
(All-Channel)



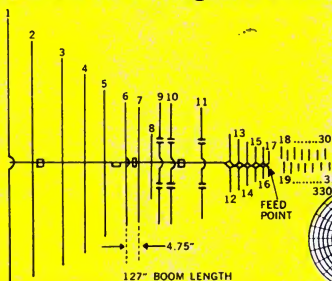
ZENITH 973-93
(All-Channel)

tenna manufacturers. They produce a combined total of over 300 different antenna models to take care of all possible combinations of reception needs and conditions. I visited their laboratories, inter-

viewed their engineers, and came back with answers for you to the important questions:

- How do location, distance, height, and terrain tie in to antenna type?

A look into the workings of the modern sophisticated antenna—design



This all-channel far-fringe design is based on log-periodic principles—a special geometric arrangement of elements for broad-band performance. The schematic represents the antenna elements of Zenith's Model 973-93 shown pictorially above. Elements numbered 1 to 11 take care of VHF and FM channels while 12 to 31 function in the UHF band. Broken down further, element No. 1 is a reflector; 2 to 8 are driven dipoles; 9,



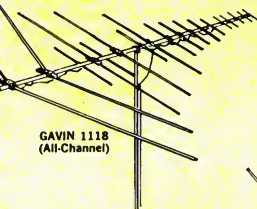
CHANNEL 2



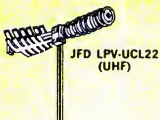
CHANNEL 4



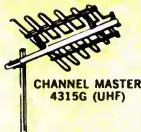
CHANNEL 6



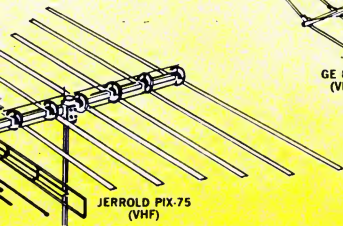
GAVIN 1118
(All-Channel)



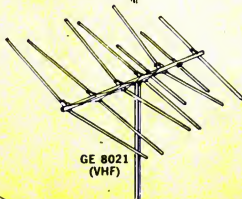
JFD LPV-UCL22
(UHF)



CHANNEL MASTER
4315G (UHF)



JERROLD PIX-75
(VHF)



GE 8021
(VHF)



LANCE LU820
(UHF)



RCA 7B141
(UHF)

• What are the reception problems and antenna solutions?

- Is there a color antenna?
- Will the old black-and-white antenna work with a color set?

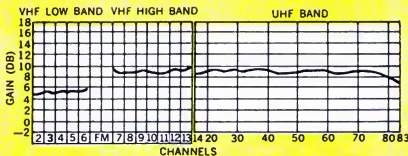
• What about rotator versus multi-antenna installation?

At Channel Master's labs, I got in on final tests of a new all-channel antenna. Typical of antenna-development labs,

Continued

features and performance specification

10, 11 are high-band VHF directors; 12 to 17 are UHF dipoles, and 18 to 31 are UHF directors. Graphs show gain across the spectrum, Channels 2 to 83 (54 to 890 mHz). Directivity graphs (also called polar patterns) on circular charts show directional performance at selected channels across the band, illustrating wide-band performance. It's typical of engineering design that goes into a modern antenna.



CHANNEL 7



CHANNEL 10



CHANNEL 11



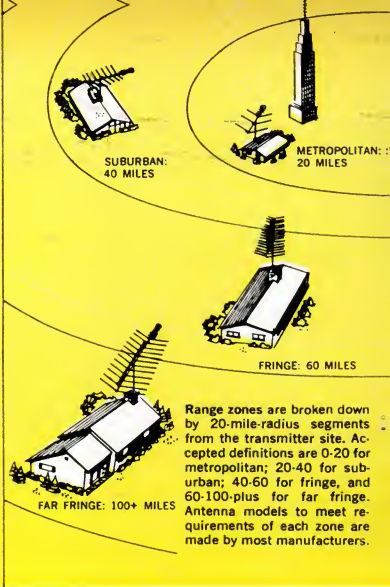
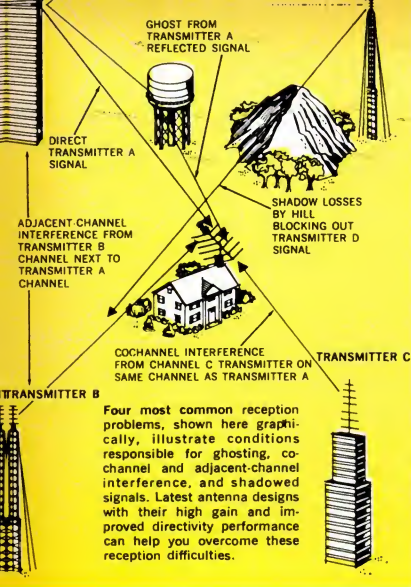
CHANNEL 18



CHANNEL 32



CHANNEL 50



complete measurements are made to describe the model in engineering terms. But, when specifying the antenna to the professional installer and consumer, a more useful performance description is used.

The engineering specs are translated to distance capability in miles from the transmitter or by zone classification—metropolitan, suburban, fringe, and far fringe. Knowing your location zone, you can look up the proper antenna.

Reception problems. Your antenna must be able to do a good job of rejecting interference from unwanted signals—a common cause of picture distortion. This is cured with an antenna having strong preference or directivity for the signal at which it is aimed. Unwanted signals can be reflected from buildings, water towers, and hills. They give the double-vision effect called ghosts.

Distorting picture signals can also come from a distant station transmitting on the same channel you're trying to see. This



Antenna manufacturers provide map aids to help select proper antenna. See-through range card from Audiotex overlays map for call-out of right model.

is known as co-channel interference. When a signal from the channel next to the one you're viewing spills over, it creates the condition called adjacent-channel interference.

The antenna must pick up enough signal from the air to give you a picture free of that speckled appearance called snow. The farther you are from the TV station, the weaker the signal and the more signal-gathering ability, or gain, your antenna must have to overcome the snow problem. Since directivity improves with increased gain, a good solution to interference is installation of a high-gain model, even though the extra gain isn't needed. This will take care of noise interference as well.

Shadow losses—weak signals caused by hills and man-made obstruction—can be solved in many cases by increasing antenna height and pointing at an upward angle.

Boosters can help. This small transistor amplifier, mounted at mast top next to the antenna, raises signal level before sending it down the lead-in cable to the TV receiver. In a weak signal location, or where noise and interference are picked up by the lead-in, a booster can make the difference between marginal reception or

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good picture quality. But it's not a cure-all. If the ratio of signal to noise at the antenna is not great enough to begin with, then amplification won't help. A wide variety of booster amplifiers to match different antenna models are available and should be considered for possible antenna-system improvement.

Color antenna—is it real? Color sets demand more signal with greater uniformity over the channel band than black and white. This doesn't mean that there are special models good only for color. It's just that, generally, performance has to be better to give freedom from color-sensitive defects.

A condition of antenna nonuniformity called "suckout" can cause severe loss of strength in some channels and not in others. This may not be serious enough to affect black-and-white viewing, but it will raise havoc with your color picture.

If the antenna you're using for black and white has sufficient gain, good uniformity free of suckout, with high directivity, then it will do a good job for color. To quote a leading GE installation Specialist, Burt Abitz of Installation Special-

Continued



Special maps for difficult obstruction areas show problem locations. JFD, Jerrold, Audiotex, Finco, and Sears among others have them for major cities.



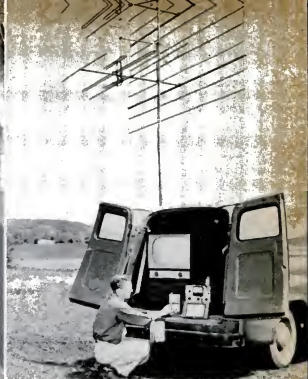
Range circles centered on transmitter location intersect TV receiving antenna site with coded call-out of proper antenna model for good viewing on your set.

Models and Prices of Representative TV Antennas

	UHF-YHF (ALL CHANNELS, 2-83)				VHF (CHANNELS 2-13)				UHF (CHANNELS 14-83)			
	METRO-POLITAN 0-20 MILES	SUBURBAN 20-40 MILES	FRINGE 40-60 MILES	FAR FRINGE 60-100+ MILES	METRO-POLITAN 0-20 MILES	SUBURBAN 20-40 MILES	FRINGE 40-60 MILES	FAR FRINGE 60-100+ MILES	METRO-POLITAN 0-20 MILES	SUBURBAN 20-40 MILES	FRINGE 40-60 MILES	FAR FRINGE 60-100+ MILES
ANDI BURLINGTON, IOWA	UV-80 \$9.95	UV-100 \$14.95	UV-140 \$19.95	UV-170 \$24.95	V-50 \$9.95	V-90 \$14.95	V-110 \$19.95	V-130 \$24.95	DO-2A \$7.95	2XOD-2A \$20.40	2XOD-2A \$20.40	AXOD-2A \$41.30
ANTENNA-CRAFT BURLINGTON, IOWA	UYEM 110 \$14.95	UYEM 120 \$22.95	UYEM 180 \$32.95	UYEM 260 \$59.95	CS-600 \$21.95	CS-700 \$29.95	CS-800 \$39.95	CS-1000 \$69.95	Y76 \$6.95	CE-500 \$17.95	G1483 \$9.95	S1483 \$19.95
AUDIOTEX HOME ELECTRONICS ROCKFORD, ILL.	32-506 \$13.75	32-509 \$24.90	32-516 \$38.75	32-524 \$59.95	32-502 \$10.98	32-706 \$16.50	32-709 \$24.90	32-719 \$41.50	32-8965 \$3.49	32-8979 \$10.40	32-8978 \$8.90	32-8978 \$8.90
BLONDER-TONGUE NEWARK, N. J.	CR 3/U6 \$15.55	CR5/U6 \$22.55	CR10/U11 \$41.90	CR15/U11 \$57.90	C-RANGER-3 \$10.95	C-RANGER-5 \$17.95	C-RANGER-10 \$33.95	C-RANGER-15 \$61.95	GOLDEN DART \$7.95	GOLDEN DART \$7.95	GOLDEN DART \$7.95	GOLDEN DART \$7.95
CHANNEL MASTER ELLENVILLE, N.Y.	3658-6 \$19.95	3655-6 \$31.95	3652-6 \$67.95	3651-6 \$79.95	3000-G \$11.39	3614-G \$25.50	3611-G \$52.50	3617-G \$84.95	4315-G \$11.80	4313-G \$18.48	4314-G \$25.56	4350-G \$43.00
FINCO BEDFORD, OHIO	CS-A1 \$19.95	CS-B1 \$40.50	CS-C2 \$54.50	CS-D3 \$73.50	CS-V3 \$11.50	CS-V7 \$25.95	CS-V15 \$59.50	CS-V18 \$59.50	CS-U1 \$22.95	CS-U2 \$15.95	CS-U3 \$22.95	P5 \$31.50
GAVIN SOMERVILLE, N. J.	1106 \$16.95	1113 \$29.95	1118 \$37.50	1134 \$67.95	1007 \$15.95	1011 \$23.95	1019 \$41.95	1026 \$62.50	J-1 \$6.95	CR-5 \$7.95	J-2 \$10.95	CR-10 \$11.50
GENERAL ELECTRIC MELVILLE, N.Y.	8030 \$25.95	8031 \$39.95			8020 \$17.95	8021 \$25.95	8022 \$43.95	8023 \$49.95				
JERROLD PHILADELPHIA	VU-831 \$19.95	VU-833 \$39.95	VU-834 \$49.95	VU-836 \$79.95	PIX 35 \$17.95	PIX-75 \$33.95	PIX-105 \$43.95	PIX-225 \$81.95	PUX-450 \$10.95	PUX-700 \$18.95	PUX-900 \$33.95	JUP-5 \$54.50
JED BROOKLYN, N.Y.	LPV-CL55 \$19.95	LPV-CL200 \$27.95	LPV-CL600 \$69.95	LPV-CL700 \$79.95	LPV-TV40 \$16.95	LPV-TV100 \$45.95	LPV-TV160 \$67.95	LPV-TV190 \$84.95	LPV-U5 \$7.25	LPV-U9 \$12.95	LPV-U15 \$19.95	LPV-UCL22 \$28.50
KAY-TOWNES ROME, GA.	CPC-12G \$19.27	CPC-18G \$27.53	CPC-24G \$39.16	CPC-33G \$57.51	ALP-5G \$15.70	ALP-46 \$21.89	ALP-11G \$31.50	ALP-14G \$42.33	AAU-5G \$11.10	AAU-9G \$14.50	AAU-19G \$24.30	AAV-21G \$27.85
LANCE SYLMAR, CALIF.	LC80C \$19.05	105C \$38.90	119C \$62.40	1011C \$73.95	LC880 \$20.30	LC881 \$29.80	LC884 \$59.80	LC886 \$79.95	L0810 \$6.95	L0810 \$10.45	L0830 \$24.85	L0840 \$34.35
MONTGOMERY-WARD CHICAGO	63C9120R \$10.95	63C9122R \$26.95	63C9124R \$39.95	63C9125R \$49.95	63C9129R \$9.95	63C9133R \$19.95	63C9136R \$33.95	63C9138R \$49.95	63C9140R \$9.95	63C9141R \$19.95	63C9141R \$19.95	63C9141R \$19.95
RCA DEPTFORD, N. J.	108907 \$14.95	108917 \$29.95	108925 \$49.95	108930 \$64.95	108807 \$15.95	108811 \$23.95	108819 \$47.95	108825 \$62.95	108-705 \$8.95	108-710 \$13.95	108-715 \$15.95	78-141 \$10.95
S&A ELECTRONICS TOLEDO, OHIO	FSM-20 \$18.25	FSM-30 \$29.95	FSM-35 \$41.50	FSM-40 \$54.95	ST-6 \$13.50	ST-14 \$29.85	ST-20 \$49.50	ST-23 \$58.95	UPW-6 \$5.95	UPW-12 \$8.95	UPW-26 \$19.95	UPW-36 \$29.95
SEARS, ROEBUCK CHICAGO	57K684L \$13.95	57K6873N \$24.95	57K6875N \$39.95	57K6877N \$55.95	57K6602N \$12.95	57K6604N \$22.95	57K6606N \$39.95	57K6608N \$57.95	57K6973L \$3.95	57K6974L \$9.95	57K6975N \$14.95	57K6976N \$24.50
WINEGARD BURLINGTON, OHIO	B450 \$10.95	SC-79 \$21.50	SC-81 \$39.95	SC-1000 \$100	B-100 \$9.95	SC-51 \$24.95	SC-53 \$49.95	SC-2000 \$100	U-50 \$7.95	U-70 \$11.95	U-965 \$14.95	U-995 \$32.95
ZENITH CHICAGO	973-89 \$21.95	973-91 \$36.95	973-92 \$49.95	973-93 \$59.95	973-83 \$19.95	973-85 \$39.95	973-86 \$49.95	973-88 \$89.95	973-101 \$8.95	973-7 \$8.95	973-8 \$14.95	973-10 \$31.95



Mechanical design to stand extreme weather is an important consideration in choosing antenna. Icing (above) adds considerable additional weight.



Field tests conducted from mobile test rigs check out signal level at remote and problem locations. This method is used extensively by antenna labs.

ties, Inc.: "Before installing an antenna for a new color set, we'll first check it out with the existing black-and-white one. If the picture is up to standard, then the customer doesn't need a new antenna."

This is good advice and can save you unnecessary cost. However, in many cases an old antenna, with poor gain and uniformity for good color, should be replaced.

VHF and UHF. With new UHF channels popping up all over, you'll want to look into updating your system. If you're trying to receive UHF (Channels 14 to 83) with the antenna you've been using for VHF (Channels 2 to 13), it probably isn't doing a good job. UHF, working at shorter wavelengths with greater signal loss, demands specifically designed antennas. Most manufacturers have a separate UHF line that can be added to your existing system. The added antenna has the advantage of permitting orientation to UHF stations in a different location from VHF transmitters.

Today, engineers are designing antennas for all-channel (2 to 83) performance. The Winegard SC-1000 and Finco CS-D3, shown on our cover, are two good examples. To accomplish this, response must be right. Engineers at Finco, for example, stress frequency-dependence design to compensate for propagation losses as you tune up the spectrum from UHF to VHF.

Rotator or multi-antenna? Living in an area where two groups of channels come from different directions is not uncommon. A location between Minneapolis and Duluth, for example, offers the possibility of getting eight-channel reception. Here, you have the choice of installing two separate antennas or using a rotator. However, there are trade-offs. Separate antennas with splitters and couplers can be expensive and unwieldy, but offer the opportunity of receiving two channels at

Continued



Model-checkout is observed at Channel Master's antenna test range by PS Electronics Editor.

PS Extra: TV ANTENNAS

the same time. In a home with more than one set, this is an added convenience. With a rotator, you receive only one channel at a time. Of course, if signals are coming in from more than two directions, a rotator is the best solution.

The lead-in. There are two basic kinds—twin-lead (300 ohms) and coaxial cable (75 ohms)—with advantages and disadvantages for each. Because it causes least

loss to signals traveling down its length from antenna to TV set with lowest cost per foot, twin-lead has a lot going for it. However, it isn't shielded. So if you're in a high-noise location, coax, which is shielded, is a better choice for keeping your signal clean. You pay for coaxial cable in both higher cost and the need for special connectors and transformers to match the commonly used 300-ohm twin-lead terminals found in most antennas and TV sets.

Don't forget construction. Your antenna is more than just a signal getter. It's also a mechanical structure subject to the stress and strain of wind, ice, and rain. Make sure of structural design in the model you choose. Check metal gauge, rivets, crossarm lock-in design, and insulator blocks. Plating is also important. The engineers I interviewed pointed out that corrosion will cause gain reduction, a symptom of aging. This also holds true for mounting hardware—masts, roof mounts, clamping bands, and guy wires. If you study our model chart, you'll see a wide range in pricing for the same electrical performance. In many cases, the lower-priced model could mean cheaper construction.

When I asked the experts for their advice on how to choose the best antenna, the answer was unanimous. Consult the professional antenna installer in your area. He knows the local reception problems from first-hand experience.

Do-it-yourself or professional? There are many special techniques and tricks of the trade in mounting and connecting a rooftop antenna. With a half-dozen or so different mast mounts, various guy-wire-anchoring methods, choice of lead-in, and methods of pointing the antenna for best results, you might do well to have the job done by a specialist. Typical installation charges are \$30 for labor and about \$10 for hardware. This still leaves you the option of choosing the antenna yourself. Most installers will put up the antenna you give them. Whether you install it yourself, or have it done by a pro, there are safety precautions to consider. Watch out for power lines. Make sure no part of your antenna system can ever get out of control to contact high-voltage cables and cause fire or serious bodily injury.

15



For best TV reception: Antenna put up by professional installation crew gives you the best assurance of getting the most out of your new antenna.

Special techniques, tricks of the trade, are used by experienced installers. Here, lead-in in looped arrangement prevents rain from entering house.





Superwide lens covers 197 degrees

Even the photographer's shoes get into the picture with the Alpa-Kinoptik 1.9mm (!) $f/1.9$ lens, made for Alpa cameras. Depth of field stretches from infinity to the lens itself. Cost: \$999.



1,000mm mirror lens is 16 inches long

Only 16 inches long and $6\frac{3}{4}$ in diameter, the $f/8$ Accura Mirror Ultratel has a focal length of 1,000mm. Mirrors provide a folded optical path to keep the unit compact. With case, the big tele lens sells for \$500.



New film offer: 12 exposures, 36 color prints

Shoot a 126 cartridge of Berkeycolor Tri-print negative color film and you get back three prints of each picture: two wallet-size, one jumbo. Film and processing: \$4.25. Atlas-Rand, Paramus, N.J. 07652.



Instamatic 414 leads new Kodak series

All five cameras in Kodak's new Instamatic series use PX-825 button-size batteries for more dependable flash performance. The 414 shown has a wind-up spring motor to advance the film and turn the flashcube. A CdS electric eye gives automatic exposure, and a two-position button offers selective focusing. 414 color outfit: about \$50.

Flashcube dot shows "green for go"

With General Electric's new flashcube, you'll never flub a picture because you tried to shoot with the "fifth" side of a four-flash cube. A green-for-go dot shows a side is unused; after use, it turns black.

New Mercedes V-8: Hottest Luxury Car in the World

Roomier than a Lincoln, faster than a GTO, the Mercedes-Benz 300 SEL 6.3 combines exceptional performance and comfort

By JAN P. NORBYE / PS Automotive Editor

Critics will say it's over-engineered, just as they have about all other Mercedes-Benz passenger cars for years. Well, I'd rather have my car over-engineered than under-engineered. The 300 SEL 6.3 features a fuel-injected overhead-camshaft V-8, four-wheel disk brakes, air springs with automatic leveling, quick-ratio power steering, and automatic transmission, all as standard equipment. Even

air conditioning is standard on this car.

If these unusual technical refinements frighten you, they shouldn't, for they are not new to Mercedes-Benz. The cylinder-head-and-valve-gear layout dates from 1951; the fuel-injection system from 1954 (with improvements); the air suspension from 1961; the automatic transmission also from 1961.

"E" is for Einspritz. The engineering systems that make up the 300 SEL 6.3 are well tried, and have nothing experimental about them. But why did they give the car that name? I can best explain that by starting at the back and working forward. The 6.3 is the engine displacement in liters (384.3 cubic inches). The S stands for *Super*, the E for *Einspritz* (injection), and the L for *Lang* (long wheelbase). The 300 does not refer to power output but to the fact that the chassis is the same as in the 300 series (with a three-liter six).

The 6.3 engine is in fact rated at 300 horsepower, which seems all wrong when you think of what 300 horses do for you in a Thunderbird. These Stuttgart-bred horses must work harder, for they take the 4,928-pound car from 0-60 m.p.h. in 6.2 seconds, 0-80 in 9.5 seconds, and 0-100 in 17.8 seconds. Top speed is about 140 miles an hour.

The fuel-injection system on the 6.3 V-8 is made by Bosch in collaboration



After the first few laps at the wheel of the 300 SEL 6.3, Norbye (right) talks it over with Rudolf Uhlenhaut, who was responsible for developing car. Uhlenhaut has been with Mercedes since 1931.



Under full-throttle acceleration out of a turn, the Mercedes stays level, with noticeable negative

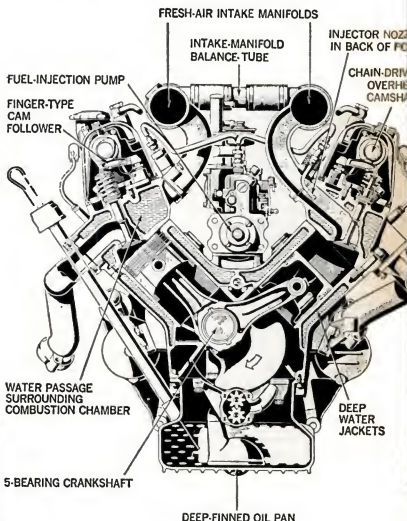
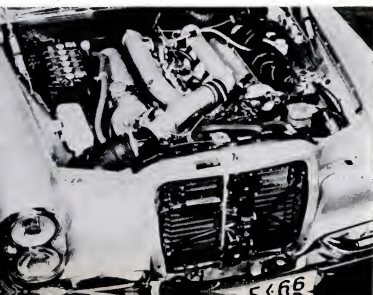
camber on the rear wheels and the nose slightly raised. The car understeers slightly all the way.

with Mercedes-Benz. The pump is an eight-plunger type, and the control system is entirely mechanical. When asked about electronic fuel injection [PS, Jan.], Rudolf Uhlenhaut, director of passenger-car development for Mercedes-Benz, said his company was experimenting with it but that the system used by Volkswagen was not yet ripe for application to a Mercedes engine. One possible drawback might be that a clogged injector could remain undetected with that system, while it would be quickly found with the mechanical system favored by Mercedes.

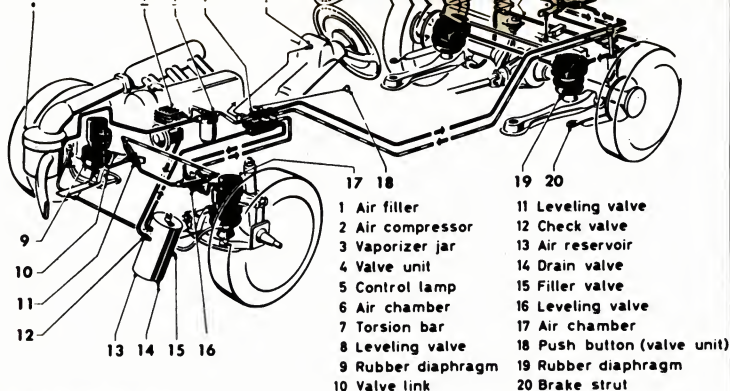
The car delivers its staggering acceleration in highly civilized fashion, without hot-rod thunder or shrieks. The independent

Continued

The engine compartment, intended for a 183-cubic-inch six, is filled to capacity with the big 300 SEL 6.3 V-8 and its multitude of accessories. Service accessibility is nevertheless remarkably good.



The engine has cast-iron block and aluminum cylinder head. Exhaust-valve stems are sodium-filled, have Rotocap forced rotation. Oil/water heat exchanger is standard. Peak r.p.m. is 5,500.



Air springs are bellows filled with compressed air from a control unit. Rear wheels share a leveling

valve; each front wheel has its own. Stabilizer bars are fitted both front and rear to restrict roll.

dently sprung rear wheels, shod with radial-ply tires, take all available torque without wheelspin on dry asphalt.

A racer with dignity. Driving the 6.3 at Laguna Seca race circuit near Monterey, Calif., was a thrill. This car takes turns like a road-racer, putting in excellent lap times without lurching, rolling, or lifting the inside wheels. It went through the trickiest maneuvers in dignified style and showed no signs of fatigue. The brakes never faded and the engine-temperature gauge never moved into the danger zone.

Mild understeer is what the chassis engineers aimed for, said Uhlenhaut. The 6.3 is directionally stable yet does not protest when thrown into a high-speed curve. The steering gear does not have a variable ratio but is very quick—only 2½ turns lock to lock. The power assist is progressive up to a point, but the initial 5½ pounds of steering effort is always manual, giving better road feel.

The transmission is fully automatic but can be up- and down-shifted manually. Like the pre-'64 HydraMatic, it does not have a torque converter but a more efficient hydraulic coupling, and four forward speeds. If the selector is left in position "4," all shifts are automatic and starts are made in second gear. For first-gear starts, you move the selector to

"2." The 1-2 shift will then take place at 4,900 r.p.m., but no further upshifts will occur until the selector is moved. Downshifts are immediate at any speed (both 3-2 and 4-3).

The springing. The air springs give a true boulevard ride, for the spring rates are considerably lower than would be possible with steel springs on a car of this weight. A suspension system like this gives an eloquent demonstration against the belief that you can get good road-holding only with stiff springs. Naturally, the large shock absorbers on the 6.3 have fairly hard settings to eliminate cyclic motions after a bump.

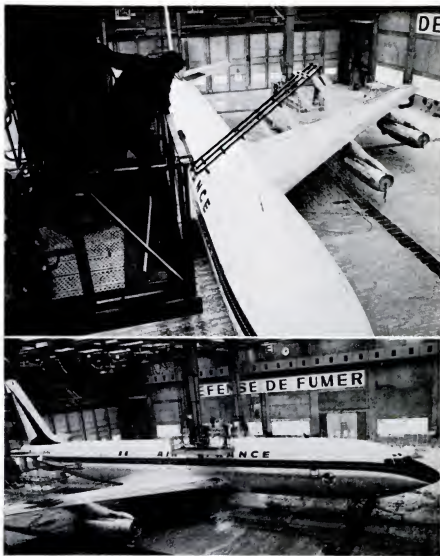
There is no risk of bottoming with a full load of passengers and luggage, because the automatic leveling assures full wheel travel for both jounce and rebound while keeping spring rates relatively low. For bad roads, the driver has a special switch on the dash that gives him an extra two inches of ground clearance.

The 300 SEL 6.3 will sell for about \$14,000. Mercedes-Benz thinks there are enough very rich men in the world who want the joy of driving a truly high-performance car without giving up any luxury. It is for them that this car was placed in production. As for you and me—well, we can dream, can't we? Or we can turn to the "220"—at \$4,360. **23**



New armored vest stops .30-caliber bullets

The protective area of this armored vest, worn by an air crewman (top), is made of boron carbide, the second-hardest man-made material and the lightest armor able to stop .30-caliber bullets. Its shielding power is shown (lower photo) as a bullet, moving at 2,700 feet per second, strikes the vest. The bullet's copper jacket strips off, and its steel core cracks. Boron-carbide armor, developed by the Norton Co., is also used in helicopters.



Automatic wash-and-dry laundry for airplanes

Resembling the familiar automatic car wash, this huge laundromat for planes was recently installed by Air France at Orly Airport near Paris. Giant Boeing 707 jets, like the one above, are pulled through on electromagnetic rails as men on elevated platforms (top) monitor the spraying. Washing and drying the big jet takes 45 minutes.



Motor tricycle gives more stability

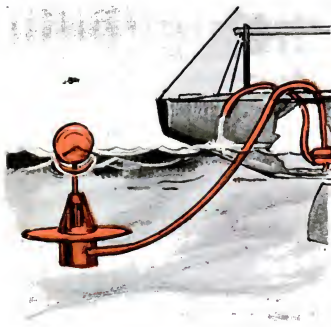
An articulated three-wheel scooter (close-up, left) is more stable and easier to ride than a two-wheeler, claims its British inventor, George Wallis. You can stop with your feet on the toeboards. A simple tubular frame is hinged to the power "chassis" by two ball joints. Another version of the Wallis machine is shown in photo at far left.



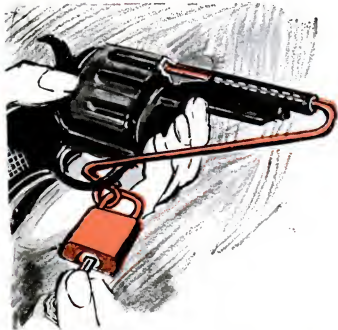
New Ideas from the Inventors

DRAWINGS BY WILLIAM CASTIMORE

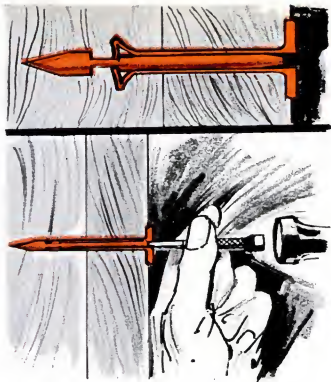
Trunk box rides in or out. Designed to tote extra luggage when needed, this recently patented carrier would be attached by shackle hinges to the floor of a car trunk. Swung outward to rest against the bumper, it would form a cargo-carrying extension. When the extra space wasn't needed, the box could be flopped over into the trunk, opened from the other side, and the space used for storage like that of any standard car trunk.



Waves power bilge pump. Tossed over the side of a moored or anchored boat, this pump would use the motion of the water to keep the bilge dry. A large disk on the submerged unit would stabilize it while a ball-type float projecting from the top would move much more freely. The difference in movement between ball and stabilized pump body would produce pumping action.



Rod locks gun chamber. Looped at one end to take a padlock, this bent rod would not only prevent pulling a gun's trigger accidentally, but would also block and lock the chamber. Inserted full length, just short of the firing pin, the straight end of the rod would extend into the bullet chamber aligned with the barrel, and thus keep a bullet from moving into firing position.



Spread tabs clinch nail. Drive this two-part nail, and tabs folded inward on the outer shell and lying flush with the nail body would travel through joined members. Setting the inner part with a punch would open the tabs, forcing them up and flaring them out, to effectively lock in the forward part of the nail and prevent loosening.



Umbrella light lights table. A fluorescent tube high in the shaft of a patio or beach umbrella would put light where you wanted it for after-dark outdoor dining or games. Metal ribs or a decorative patterned grillwork would protect the glass tube. Its light would be shaded and at the same time reflected downward by the overhanging umbrella.



Hinged ship flexes in waves. The effective length of a cargo ship may be limited by the ability of the hull to withstand bending stresses that lift one section more than an-

other. This hinged coupling would let sections adjust to wave motion with little strain. Ballast tanks in both of the sections would compensate for unequal loads.

The following patents have been granted on these inventions: **Spare trunk**—No. 3,365,084 to J. D. Fernicola, Centreville, Md.; **Wave pump**—No. 3,362,336 to Robert S. Kafka, Maitland, Fla.; **Gun lock**—No. 3,368,297 to Morgan E. Lentz, Rutherford, N.J.; **Clinching nail**—No. 3,368,446 to C. A. Glenn, West Hartford, Conn.; **Lighted umbrella**—No. 3,313,929 to E. L. Schiavone,

Silver Spring, Md.; **Ship coupling**—No. 3,370,564 to G. Archer and K. E. Schoenherr, Washington, D.C. Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 50 cents each. To write to an inventor, if the address above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.

Self-Leveling Headlights

Glue Beams to the

Regardless of load, braking, or acceleration, your headlights will stay dead on target

By DAVID SCOTT/PS European Editor

European cars may soon appear with a simple self-leveling headlight system that holds the beams on the road regardless of trunk load or back-seat passengers. The beams stay dead on, even if you nose-dive on braking or squat on a hurried takeoff.

Citroën has had self-leveling lights integrated with its complex hydro-pneumatic suspension for several years. But the new system could put this ant glare safety feature on any car. Designed by Pat Martin, inventor of steerable headlights [PS, Feb.], the rig would cost only a few dollars factory-installed.

Martin's scheme calls for measuring trunk and rear-seat load with spring scales, and tilting the lights down to correct for squat. Trunk and rear seat are pivoted at rear, with the load carried on springs at the front end. Bell-crank levers react to load variations and pull wires according to position. Tandem rear-seat levers operate the individual wires

that angle each of the lights separately.

The cunning bit. These levers both add and subtract. They integrate two variables—trunk and seat weights.

Each is a lever fulcrumed on a lever. Pivoted at the base of the bell crank on the tunnel is a secondary arm to which the trunk wire is tied. The wire running to the lights is connected just above the lower pivot.

Thus, the movement of the headlight wire is controlled by both trunk and seat bell cranks, but independently with a differential action. This is because the trunk-wire attachment point on the compound lever is close to the main pivot on top, so any movement of the seat lever has little effect on the height signal from the trunk lever.

The real crafty stuff is in the headlight units themselves. For each one, the tilting linkage operates through a pendulum that swings the beam down when you accelerate, up when you brake.

The 2½-pound suspended weight—the only link with the light—is hung from a longitudinal slide. The wire signal from the car's rear moves the slide horizontally, and this travel is passed on to the light from the top of the pendulum.

Thus the pendulum is a variable refer-

Linked at top to a pendulum and pivoted on the sides, the self-leveling sealed-beam headlight tilts under the push of a fingertip. But the dashpot resists uncontrolled movement. Up-and-down headlight swing is eight degrees.



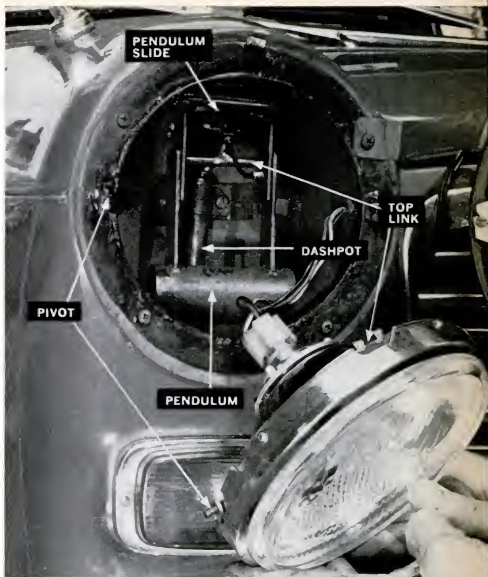
Calibrated springs support the front of the trunk deck, which is pivoted in the back and bears against the roller on a bell-crank lever with two short arms that pull on piano-type wires. The front corners of the deck are steadied by blocks of foam plastic.



Road



Self-leveling headlights are set in normal position on Pat Martin's Morris 1100. They're paired, here, with fixed sealed-beams on the inside. A special switch permits instant change-over from one set to the other for comparison tests. At right, the self-leveling headlight is disconnected from its pivot. A pendulum assembly receives a static-load signal from the rear slides and adjusts itself accordingly.



ence point for the whole self-leveling system. Its fore and aft position for static control of the beam is fixed by the car's load. And from this position, it responds to inertia for dynamic control.

Enlisting gravity. The pendulum is also affected by gravity to tilt the light on hills. When you climb, the beam dips, compensating for tail-end sag caused by

the rearward shift of the car's center of gravity. Or the beam rises on a descent. A dashpot coupled to the pendulum prevents oscillation or over-correction.

Britain's Road Research Laboratory checked out Martin's system and gave it high marks. For details, write Fred Bauer, Intercontinental Aviation Services, Box 1704, Beverly Hills, Calif.

Compound levers under the rear seat integrate the weight on the cushion with the load in the trunk, and signal the sum to the headlights, which tilt accordingly. The corner spring is combined with a dashpot damper to prevent jouncing of the framework beneath the cushion.

Graduated screen in Martin's garage easily checks headlight correction under load changes and sharp braking. Horizontal lines on screen are three inches apart, and each equals a one-degree angle when car is 15 feet from screen.





Noses go to work for GM

GM's Research Laboratories have many instruments at their disposal, but recently discovered they had no way of measuring diesel-exhaust odor. So they put the human nose to work, in this "sniff mask" demonstrated by Dr. Gerald J. Barnes.



Bike steers like a car

This youngster is riding high on a bike called—naturally—The Wheel, which was marketed recently by Huffy. The steering wheel turns the front wheel clear around. The bike also has a lever brake and a chain guard that looks like exhaust pipes.



Safety items to protect auto riders

Two Japanese-developed safety devices cushion passengers in the event of a collision. Nylon nets (above), placed in front of and behind the driver's seat, are said to



keep the driver from being thrown backward, or forward through the windshield. Another device is a bag that fills with freon gas in 1/50 second. The shock of a collision opens electrical circuits that cause the polyethylene bag to inflate to form a safety cushion.



Piper Cub is shown as it comes to a safe landing on cabin roof of speeding houseboat.

Engine power turns a houseboat into a tiny flattop

A houseboat with a "landing strip" sounds impossible, but Thunderbird Products proved it could be done. The company mounted three 200-hp. Mercury stern-drive engines on their Drift-R-Cruz so that it could build up a 40-m.p.h. speed—enough to enable a lightplane to take off (photo at right) and land. The speed is sufficient to allow the Piper to become airborne almost at once. It also equals the plane's landing speed.



Electric shopping cart has a built-in push

William G. Waggoner of Sacramento, Calif., designed this cart (left) to make shopping easy all the way home. He attached a basket to his electric golf cart to get the unusual shopping aid. The back of the basket is supported by pipe legs that sit astride the frame. One thumbscrew holds it in place. Now if he can only turn a shopping wagon into a golf cart. . .



Combination wrench-screwdriver (on log) comes with saw, is used to remove cover for access to engine.

In fast one-hand start, chain is already in motion and the engine started before the rope is out.



PERSONAL-USE REPORT:

New One-Hand Chain Saw

By V. LEE OERTL

PHOTOS BY RALPH POOL

If you think you've seen everything in compact chain saws, wait until you get your hands on McCulloch's new Power Mac 6. Billed as the "world's lightest chain saw," this supercompact 6½-pounder (weight without cutting bar) can even be used occasionally on heavyweigh wood-cutting chores.

I tested one recently on an oak-studded ranch deep in Malibu Canyon, Calif. After putting the saw through its paces on all types of cutting jobs, I can report that it cut with the ease you usually find only in bigger saws. But there is a difference. This one does it with a lot less strain on your arms.

Five-point test. Since oak is a challenge to any saw, the site offered a first-class opportunity for the saw to prove itself. I concentrated on the points that are most important to the occasional chain-saw user. Here's what I found:

- **Starting.** A relatively short, sharp

Sturdy pair of handles gives operator safety when making overhead cuts. Saw stays where it's held.



tug on the rope revved up the rig on the first pull every time. Surprisingly, after the first start the choke is seldom needed. Compression is excellent in this little 1.96-cubic-inch two-cycle engine; you can actually feel the torque as the engine kicks over.

- **Balance.** The Power-Mac 6 feels right in your hand. The appliance-type handle, built over the saw's center of gravity, gives both safety and leverage. To prove it, I held the saw out at arm's length and opened and closed the throttle rapidly several times. Torque motion was in a straight-up lift; this is a real aid to the user as straight cuts are more easily started when there is no sideways torque to contend with.

- **Cutting power.** Whether slicing a 12-inch log into fireplace-size pieces, trimming four-inch dead limbs, or clearing out underbrush, the saw chewed away furiously. Cuts were clean, quick, and easy. One reason is the extra-narrow cutting chain. The hooded teeth on it are only about a quarter-inch wide. The smaller width means less friction surface under the blade. And as long as you maintain full-throttle grip, the blade never hesitates. If r.p.m. falls off, the chain grabs and kills the motor. Restart is quick; a short tug on the rope gets it going again and in seconds your cut is completed.

- **Noise level.** From past experience with chain saws I've learned that in order to maintain lugging power, most are designed so that the engine will run at peak r.p.m. And high r.p.m. is noisy. Evaluating a tool's noise level can only be done by comparison. The Mac 6 makes just slightly more noise than my gasoline-powered lawn mower. Happily, it lacks the screeching whine and loud roar I've found in other compact saws. If you live in a

[\[Continued on page 209\]](#)

It gets into spots bigger saws can't. Here, small size permits trimming dead limb close to ground.



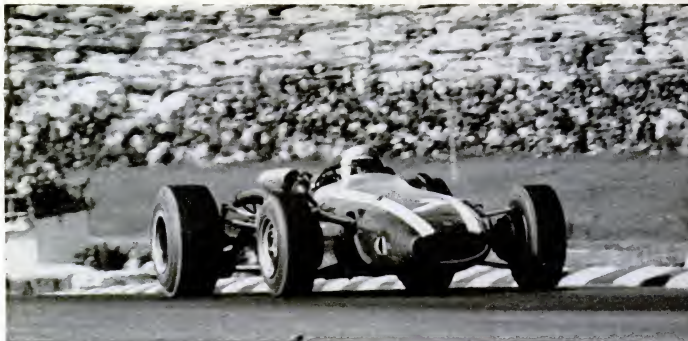
Light weight (eight pounds, five ounces with cutting bar and chain) permits one-hand trimming.



Looking more like a carving knife than a chain saw, Mac 6 cuts through a 12-inch oak log in seconds.

Rugged test proved that little unit can rip quickly through big logs without hesitation or hang-up.





Enthusiastic crowd of 80,000 watch as John Surtees (Cooper-Maserati) hotly pursues Lorenzo B.

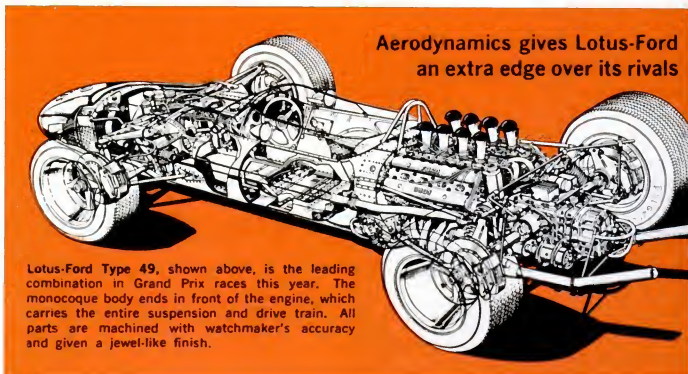
U.S. GRAND PRIX

...road racing at its very best

Now you can see the world's fastest road-racing cars in America—at Watkins Glen

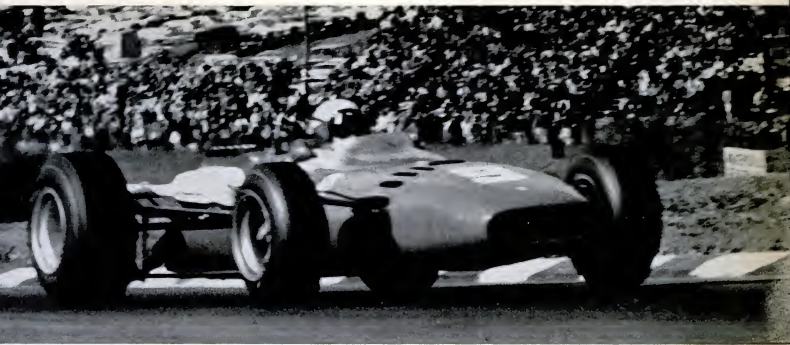
By JAN P. NORBYE / *PS Automotive Editor*

What will draw 80,000 enthusiastic spectators to a little town in the Finger Lakes region of New York State, on Sunday, Oct. 6? The U.S. Grand Prix at Watkins Glen—one of the 11 events in the international Grand Prix series.



**Aerodynamics gives Lotus-Ford
an extra edge over its rivals**

Lotus-Ford Type 49, shown above, is the leading combination in Grand Prix races this year. The monocoque body ends in front of the engine, which carries the entire suspension and drive train. All parts are machined with watchmaker's accuracy and given a jewel-like finish.



rrari) during an earlier event at Watkins Glen. Hilly countryside provides spectators with fine view.

And what is the attraction of Grand Prix racing? It's not sheer speed, for oval-track stock cars hit higher averages. It offers nothing like the special thrills of drag racing. Grand Prix racing generates an excitement all its own. I think it has to do with the real country-road type of driving. Drivers must exercise the most precise judgment on brake points, shift points, and the fastest line through a variety of turns. These are skills you don't need at Indy or Daytona. In a field of over 20 cars, traffic is dense enough for a lot of hairy passing situations. And once

you learn to recognize each car and its driver, you quickly get caught up in the tension that surrounds the racing scene.

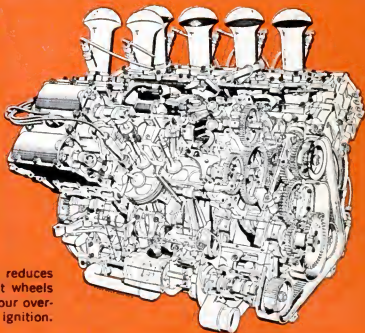
Grand Prix drivers are generally held to be the best in the world. They race against each other all the time—and they trust each other. But competition is fierce and they are all out to win.

The 400-hp., single-seater racing cars are restricted to a minimum weight of 1,100 pounds and a maximum engine size of 183 cubic inches without superchargers; must have a reverse gear and self-starter; run on 100/130-octane aviation gasoline.

Continued



Wedge-shaped engine cover deflects airflow over the tail and reduces high-speed lift, while stub wings on the nose keep the front wheels firmly on the ground. At right: the Cosworth-Ford V-8, with four overhead camshafts, four valves per cylinder, and electronic ignition.



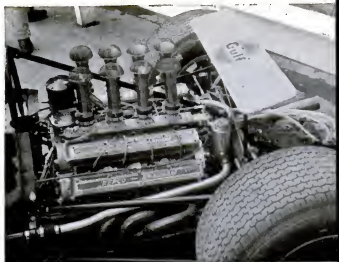
The winner of a Grand Prix race is awarded nine points towards the world's championship, second man gets six, third man four, fourth man three, fifth man two, and sixth man one point. At the end of the season, each driver counts up the points gained in his best nine races out of 11 events: the Grand Prix of South Africa, Monaco, Holland, Belgium, France, Germany, Great Britain, Canada, Italy, U. S., and Mexico.

Last year, Denis Hulme got the world champion title with 51 points, followed by Jack Brabham with 46. Both were driving Brabham cars with Australian-built Repco V-8 engines. This year, Graham Hill, who drives a Lotus, leads on points after six races followed by Denis Hulme (Brabham), Jackie Stewart (Matra), and Bruce McLaren (McLaren). The U. S. Grand Prix could be vital in deciding this year's championship.

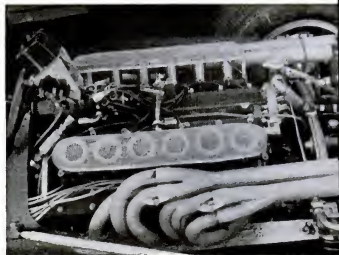
The Watkins Glen race lasts only about two hours (the minimum duration for a Grand Prix event) but there are three full days of activity at the track. Practice begins on Friday before the race that takes place on Sunday; Saturday is also a practice day. And the man with the fastest car in practice gets the best starting position.

Practice isn't so important for the drivers, but is mainly to let the engineers adjust the carburetors just right, set the springs, and make sure the gearing is the best possible for the course.

The slowest turn, right before the pit straight, can be taken at about 45 m.p.h., which means second gear (even first for some). At the end of the long straight that follows, the fastest cars reach 175 m.p.h. in top gear. Then they have to brake and downshift for a long loop, downhill, with no banking, before building up speed again for the very fast



Latest version of Repco V-8 used in Brabham cars has four overhead camshafts and four valves per cylinder. Engine weight is only 368 pounds.

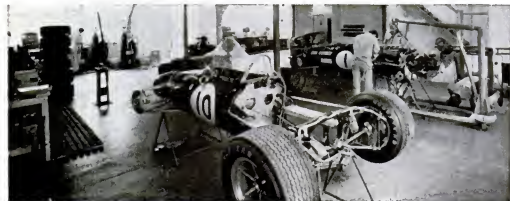


Ferrari's famous V-12 has four overhead camshafts and three valves for each cylinder, Lucas fuel injection, and Marelli electronic ignition.

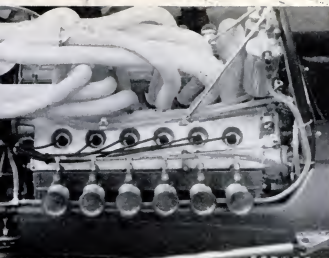
bends on the way back to the beginning.

Last year's race was won by the late great Jimmy Clark in a Ford-powered Lotus at an average speed of 120.95 m.p.h., a fantastic performance for 108 laps of the tricky 2.36-mile circuit.

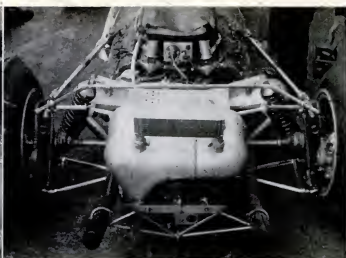
How the '68 U. S. Grand Prix shapes up, including the drivers you can expect to see in action, is shown at right.



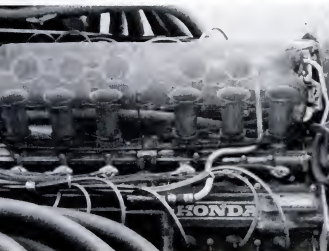
AAR (All American Racers) build Dan Gurney's Eagle cars in small but modern factory in England, shown at left. The chassis in foreground is basically the same as the Eagles that finished first and second at the Indianapolis 500 this year. They were driven by Bobby Unser and Dan Gurney.



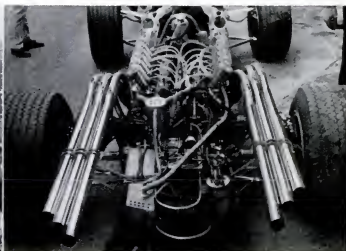
BRM V-12 differs from normal practice in having exhaust pipes between the banks and a separate intake manifold on each side of the engine.



Most-recent modification on the Lotus-Ford is an oil tank straddling the gearbox, with an oil radiator exposed to the airstream on top.



Honda V-12 has 90-degree V (against 60 for Ferrari, Eagle, BRM, and Matra) and a roller-bearing crankshaft derived from motorcycle practice.



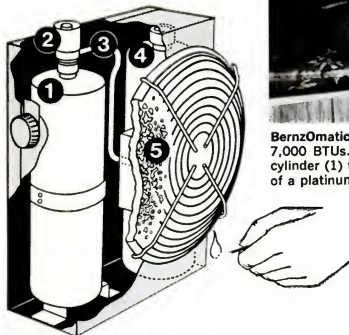
Matra V-12 is a real showpiece with four overhead camshafts and four valves per cylinder. Intake ports go straight down through the cylinder head.

Make	Engine	Power @ r.p.m.	Weight	Tires	Drivers
Lotus	Cosworth-Ford V-8	410 @ 9,000...	1,107.	Firestone	Graham Hill, Mario Andretti
Brabham	Repco V-8	400 @ 8,800...	1,130.	Goodyear	Jack Brabham, Jochen Rindt
Eagle	Gurney-Westlake V-12	415 @ 10,000.	1,162.	Goodyear	Dan Gurney, Ron Bucknum
BRM	BRM V-12	375 @ 9,750...	1,220.	Dunlop	Pedro Rodriguez, Richard Attwood
Matra	Matra V-12	400 @ 10,000.	1,205.	Dunlop	Jackie Stewart, Jean-Pierre Beltoise
McLaren	Cosworth-Ford V-8	410 @ 9,000...	1,135.	Goodyear	Denny Hulme, Bruce McLaren
Ferrari	Ferrari V-12	420 @ 10,500.	1,116.	Firestone	Chris Amon, Jackie Ickx
Honda	Honda V-12	440 @ 11,000.	1,140.	Firestone	John Surtees
Cooper	BRM V-12	375 @ 9,750...	1,175.	Firestone	Brian Redman, Jo Siffert

Thousands of racegoers camp in the infield of Watkins Glen race track, some in tents, others in camper trucks or mobile homes. For a few days it looks as if a city has sprung up. For information, write Watkins Glen Grand Prix Corp., Watkins Glen, N. Y. 14891 or call (607)535-2500 or (607)535-4300.



New Catalytic Heater Uses Propane



Here's a safe, flameless outdoor heater to make outdoor living comfortable all the year round

By HERBERT SHULDINER

Campers who prefer the convenience of LP-gas fuel over liquid gas can now round out their collection of camping gear with a propane catalytic heater that offers safe and effective heat for the outdoorsman.

The new BernzOmatic catalytic heater is safe to light inside a tent or camper, or on a boat. You don't have to prime the head, so there's no flare-up when you ignite it. You start it up by turning the combination on-off/heat-control knob and holding a match in front of the platinum-impregnated head.



BernzOmatic's catalytic heater (extreme right) puts out up to 7,000 BTUs. Cutaway drawing (left) shows how fuel travels from cylinder (1) through valve (2) and fuel line (3) to a head (5) made of a platinum-impregnated fiber. Heater carries spare cylinder (4).

It takes about 15 seconds to get going. Then, almost immediately, the heater achieves full efficiency with an output that ranges from 1,000 to 7,000 BTUs, depending on how much fuel you feed. It is smokeless and odor-free.

The heater will keep an outdoorsman cozy at temperatures down to minus 25 degrees F. It consumes fuel from the same type of cylinders you use on a propane torch, but can be fed from a bulk tank (with an optional adapter kit). It will operate for three to 18 hours on a single cylinder, depending on the temperature setting. There is space inside it for the cylinder in use and a spare.

With the adapter kit, you can hook up the heater to a bulk tank with a whole system of propane-burning devices—keep everybody warm, do your cooking, and run a lantern, all at the same time.

Like other catalytic heaters, the new BernzOmatic is extremely productive of heat because it loses almost no energy as light. Practically all the energy produced by the oxidation of the propane fuel is turned into radiant heat.

Although the heater puts out an aston-

[Continued on page 212]

Rout-About Is a Shaper, Too

By GEORGE DANIELS

The latest accessory for Stanley's little Rout-About router is a kit that converts it to a shaper in less than two minutes. It's worked with a cute gimmick—the metal carrying case doubles as a small shaper table.

The mounting screws (which fill the threaded holes in the base of any Rout-About) automatically center the cutter shaft in the table's cutter hole. Depth of cut is adjusted simply by moving the router body up or down with its built-in spiral adjustment. Clamps are the easiest way to mount the shaper; for permanent installation it can be screwed through holes that are provided in the shaper base.

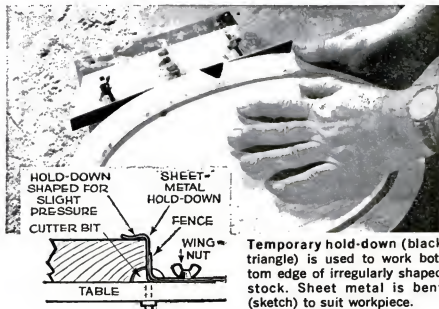
The big advantage of owning a shaper is that in precision work you can get greater accuracy than with a hand-held tool. Example: You can make moldings from thin stock on which it would be difficult to ride a router.

And the shaper kit's portability lets you bring this versatility to outside jobs; hurried trips back to the shop to a fixed tool to make a cut or two are eliminated.

If you already own a Rout-About, you can pick up just the \$2.50 conversion kit. The complete kit is \$44.95.



You mount it under the cutter-bit hole with screws, as in top photo. Two small C clamps hold the base securely, yet keep the tool portable. When shaping narrow moldings or grooving thin stock (above, left), a scrap of wood clamped to the base insures that stock will slide snugly against fence. For edge-grooving (above, right), guide fence is positioned so that bit cuts groove where it's wanted.



Temporary hold-down (black triangle) is used to work bottom edge of irregularly shaped stock. Sheet metal is bent (sketch) to suit workpiece.

Gus Discovers a Secret Mileage Ingredient

By MARTIN BUNN



Stan grabbed the microphone in Heck's wagon as Gus steered his irate customer aside.

**When the bakeryman decided he had to save gas—
Gus had to figure out how to save a customer**

"Do you realize how much I spend on gas?" Lou Heck asked Gus Wilson aggressively.

"I've got a pretty good idea, Lou. You buy most of it right here at the Model Garage," Gus replied with a twinkle. "And at a volume discount."

Gus also knew that the slightly built,

fortyish man—owner and operator of Heck's Homestyle Bakery Products—knew, too, probably to the penny. Those cold blue eyes behind steel-rimmed glasses kept a close watch on the expense records, to make sure that his eight light delivery trucks were an efficient and profitable part of his operation. With Lou



ILLUSTRATION BY RAY QUIGLEY

Heck, gas mileage was close to being an obsession.

"Volume discount, sure. But with gas consumption, I've had it clear up to here." Heck gestured across his Adam's apple. "Like I was telling my boys, the four new trucks in my fleet are off an average of 2.4 miles per gallon compared to the older ones, and this wagon, why, it's awful."

Heck pointed in the direction of a sleek new Ford station wagon he used for personal transportation and special deliveries.

"Well, let's have a look at it, Lou."

"Actually, Gus, this car should be in perfect tune." Heck eyed Gus carefully. "I just had my first dealer-warranty service, and I'll be turning it over to you for maintenance from now on."

Before Gus could ask the purpose of the visit, Heck scurried to the rear of the wagon, opened the tailgate, removed a brown shipping carton and plunked it on the bench.

"I want you to put these on. Like I was telling my boys, they'll save a mint on gas. As soon as I calculate the cost-to-savings ratio, we'll probably install them on the trucks, too."

Gus recognized most of the things Heck fondly sorted through—among them a set of shiny chrome so-called fire-injectors, special carburetor jets, a cylindrical gadget supposed to increase spark intensity, and a "fuel-pressure regulator."

"Very conservatively, these items should double my mileage." Heck's thin lips curled with satisfaction as he waved a fistful of gaudy brochures boldly proclaiming: "Save Gas!" in Gus's face. "I'll radio one of the boys to pick me up and you can put 'em on."

"Lou, you're a good customer, and I don't know quite how to put this, but I can't install these for you."

"What do you mean, you can't install them?" Heck slammed the carton lid shut. "Cost you too much gas business, huh?"

"As hard as it is to satisfy customers with gas mileage these days, if I thought these accessories would help, I'd be selling them myself. But it's been pretty well established that on a properly tuned car, they don't. If you want to talk about mileage..."

"Forget it, Gus," Heck said curtly. "I'll put them on myself."

Monday morning was cool, and so was Heck's greeting to Gus as he eased up to the pumps.

"Fill 'er with regular this time. Like I was telling the boys this morning, I shouldn't be needing high test any more. And be careful to just fill it to the brim. I want to keep a careful record of the mileage."

Gus figured it would be well to keep his mouth shut as Heck methodically en-

Continued

tered the figures into a pocket notebook. "Shouldn't be stopping as often now." Heck floorboarded the powerful machine as he drove off.

Watching the wagon rocket down the street, Gus was hardly aware that one of Heck's shiny delivery trucks had eased up to the pumps for a daily fill.

"Morning, Mr. Wilson," young Mike McGlenn greeted Gus, a grin on his big, freckled face. "Boss bugging you about gas mileage?"

"Sure is." Gus's grim face relaxed a bit. "If I could just get him to under-

trucks stopped in, it reminded Gus of the strained relations.

"Stan, take over," Gus told his assistant one morning. "I'm going down to the diner for coffee and a doughnut."

"Something bugging you, Gus?"

"Stan, it's just not right when good customers are cold the way Lou Heck has been."

This was just about the time Heck stopped in at the diner for a coffee break. Gus spotted him down at the end of the long counter.

"Morning, Lou." Gus forced a big smile as he eased onto a stool. "I'd like to..."

"You needn't ask. I was just heading over to tell you the great news." Heck's face lit up. "Fluctuates, mind you, but would you believe 22.7 miles per gallon? Did you hear that! Lots of town driving, too."

Gus heard, but his first thought was that Heck was either lying or had miscalculated somehow.

"Yep," Heck continued, "just completed the figures

on 2,000 miles. But that gas you sell is lousy. Car pings."

All Gus could do was act pleased with Heck's superb mileage and offer to check the gas complaint.

"Fine. Drop me off at the plant. You drive it to the shop and check it over. But you mess up my little gold mine in the process and you've had it."

The big engine did ping a bit on acceleration. Probably a slight timing adjustment would fix it, Gus figured.

But the timing proved almost perfect, as did the tune of the entire engine. Gus spent an extra long time on the engine, including checking out the gadgets Heck had added.

Gus road-tested the car again and finally, back at the Model Garage, retarded the spark slightly to eliminate the spark knock entirely.

"Hey, you still in the gas business?" Mike McGlenn and another Heck driver stood in the open front door.



stand that he's not going to get mileage like he got with the stick-six hardtop he traded on that big wagon. It's just not in the book."

"Well, he's going to get it now. He told us so this morning," Mike replied. "I've got to get on my route. Fill the truck, and, oh, give me two gallons in this can for my—ah—scooter. I'll pay cash for that."

Heck was back on premium the next fill but Gus carefully avoided mentioning the fact.

As the days passed, it did seem that Lou Heck wasn't coming by as often for gas, but Gus passed it off, figuring that what with being so abrupt with the guy, maybe he was lucky Heck was coming in at all. And after all, he was doing the usual business with Heck's delivery trucks and, besides that, regularly picking up can sales from their youthful drivers for their boats and scooters.

Each time one of Heck's neatly lettered

Gus closed the hood and walked toward the pumps with the young men.

"You working on Mr. Heck's wagon again?" Mike asked casually.

"Your boss thinks I've been giving him bad gas. Need gas for your scooter this trip, Mike?"

"No, not this time, I guess."

"How about you, Tom?" Gus turned to the other driver.

"Well . . . no. I'll be docking my boat for the season, I guess."

"Gus, you fixed the ping." Heck was his old, friendly self again, in for his first fill after Gus had worked on the wagon. Whipping out his notebook and slide rule, he checked the odometer and watched the gallonage wheels tumble to a halt as Gus topped the tank.

"What are you trying to pull?" Suddenly Heck's eyes narrowed. "My mileage is back to what it was before I put the gas-savers on!"

"But Lou, I . . ."

"But, nothing. You put my accessories back this instant or you're through with Heck's Bakery Products! Why, I'll be a laughing stock with my boys!"

"Take it easy, Lou." Gus calmly opened the hood. "See, all your gadgets are there. But I think you just gave me the clincher about what happened to your mileage. Will you let me use the radio to call your office?"

"Humph! Go ahead. Use the radio."

Gus motioned to Stan. The pair exchanged a few muffled words. Then Stan grabbed the microphone in Heck's wagon as Gus steered his irate customer aside.

"The dispatcher says Mike doesn't own a scooter, Gus," Stan called out, hanging up the mike. "And Tom hasn't got a boat."

"What is all this nonsense?" Heck demanded.

"It means"—Gus was stoking his pipe, a triumphant gleam in his eye—"you should have installed one more accessory—a locking gas cap."

"Nobody was stealing my gas. It was like . . ."

"Like somebody was secretly adding two gallons of gas to your tank each day, starting when you put on the gadgets. They knew the game was up the day I worked on the spark knock."

"One of my employees? Tell me who it was and I'll fire him!"

"Calm down, Lou. You're going to be awfully shorthanded if you do. All eight of your drivers were in on the plot."

"But how—why?"

"Well, the way I figure it, they got pretty tired of hearing you go on and on about gas mileage, and they figured they'd—well, teach you a lesson. I started to suspect something fishy with all your drivers wanting two gallons of gas in a can. They were buying regular, which was why your wagon pinged. But they were just needling you, Lou."

Heck seemed to be cooling down a bit. "You mean I shouldn't take disciplinary action?"

Gus grinned, "Well, they were paying for it out of their own pockets—and I don't know how you could have gotten two gallons a day any cheaper than that." [E]

Stopping scale from driver's seat

Chevrolet engineers rigged this demonstration of how far your car would go before it halted, if you wanted to make a panic stop at the moment the picture was taken. The closest sign is where you'd stop if you were doing 30 m.p.h.—69 to 78 feet. Farthest stopping distance is 228-268 feet. Other stopping distances are 108-124 feet at 40 m.p.h., 160-



186 at 50 m.p.h. Distances are calculated for braking on dry, level pavement.



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PLUS good storage ideas



Banish gloom from a hallway. Skylights may be the only way to bring natural light into an interior hall. For a gabled room, use a light shaft as shown on the following pages.

WINDOWS IN THE ROOF: exciting way to remodel

By A. M. WATKINS



Look at the stars? That's an added advantage of placing a skylight in an attic room. Or you can spy on the moon when it's in the right position. By day, of course, you get lots of extra light in the room.

Dormers are no longer the only way to bring air and light into an attic room. You can now use one of the new skylights—and get the same light and air much more easily and cheaply.

And here's another remodeling fact that may be a surprise: You can even use a skylight these days to help illuminate first-floor rooms in a ranch house. You do it by running a light shaft down through the attic to the first-floor ceiling. A new roof dome can be the solution to your light and air problems.

Skylight domes are a natural way of letting stale air, smoke from a party, or hot humid summer air escape from a house. You can hurry along the escape of smoke and hot air by installing a dome with a built-in exhaust fan—a fine idea, too, for kitchen or bath.



Save wall space by installing a skylight in roof or ceiling of a kitchen and you can reserve the wall space for cabinets. Open the dome and you have a natural exit for cooking fumes and kitchen heat.

The new skylights are, in effect, roof window units made with a rugged acrylic plastic that's 15 to 20 times stronger than glass. The material won't fade or discolor in the hot sun.

Some skylights are sealed, but others are made to open. A screen is a standard accessory to keep out insects when the unit is open.

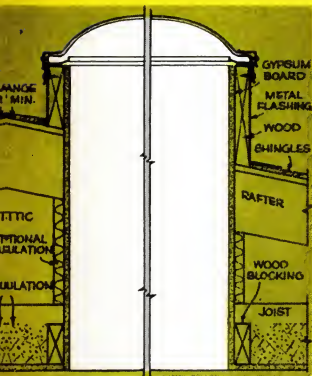
The skylights come with clear, colored, or white translucent plastic. Some have a double layer of plastic with dead air space between to cut heat loss and prevent condensation.

White and colored models reduce sun heat. Clear plastic lets you see the stars.

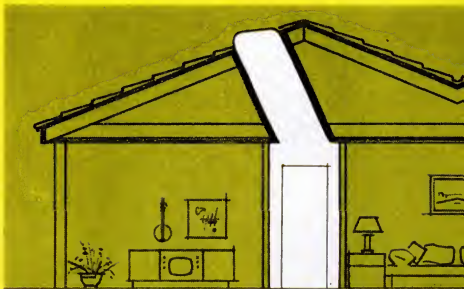
Prices range from about \$35 for the smallest (16 by 24 inches) to about \$175 for one 48 by 48. Models that open for

Continued

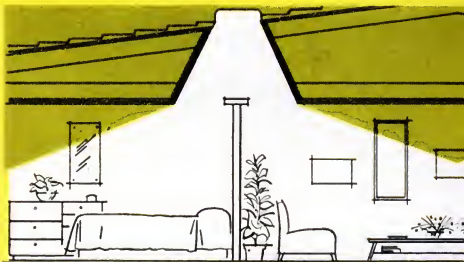
News about roof domes: Light can shine down the shaft into first-floor rooms



A light shaft down through the attic makes it possible to use a roof dome to help illuminate the interior of a ranch house. In most cases, the skylight can be put in the roof directly over the ceiling location desired and the shaft run straight down, as in sketch above. Other ways to do it are shown in drawings at right.



Tilted shaft is your solution if the skylight cannot be set into the roof directly over the ceiling of an inside hall or bathroom.



Two adjoining rooms can each get illumination from a single skylight if you install splayed shaft to straddle partition as in above drawing.

Splayed light shaft lets illumination spread over a larger area inside the house. As sketches below show, you can use this type for either a pitched or a flat roof. In the two photos at left you see how an actual installation was made. Line shaft with gypsum board, tape joints, and finish in the usual way. Paint wallboard to match ceiling and you'll hardly notice that there's a shaft opening overhead.



ventilation of the room run from about \$85 to \$225.

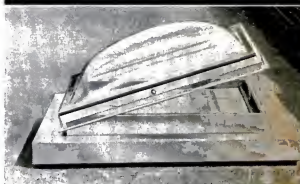
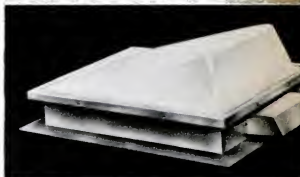
Generally sold by lumberyards, skylights are made by many companies. Among them are:

American Cyanamid, Building Products Div., Box 350, Wakefield, Mass. 01880; APC Corp., 179 Goffle Rd., Hawthorne, N.J.; Bohem Mfg. Co., Lancaster Ave., Rosemont, Pa.; Hillsdale Industries, Industrial Park, Hillsdale, Mich. 49242; Naturalite, Inc., 3233 W. Kingsley Rd., Garland, Tex.; Ray Mar, Inc., Box 20499, 2616 Andjon Dr., Dallas, Tex. 75238; Ventarama Skylight Corp., 174 Main St., Port Washington, N.Y. 11050. **ES**



A dome can sub for a dormer, as in this case. There was already a dormer and no space for another one because of an intersecting roof.

Some skylights open for ventilation, like the spring-loaded model below. It opens when you tug on pull chain. For another, you use a hooked pole to open or close the latch. Still others are operated electrically.



Flat or shed roof? Three skylights at top are typical of those you can install. They come in clear, colored, and white translucent plastic. All are sealed units with integral flashing to go under roofing. A built-in fan is part of one skylight (fourth from top), designed for installation on a sloping roof. The fan is a good idea over kitchen or bath areas. Combination window-and-door unit (bottom photo) is the answer if you want access to a flat roof as well as light. It also provides ventilation when opened up as shown in the photo.

How to Use 6 New Home-Improvement



First step in preparing for insertion of new window is removal of inside stops (photo, left). Next, sash cords are cut and sashes removed. After cleaning

the opening with a brush or vacuum cleaner, cord pulleys are hammered flush with the jamb to provide flat surfaces on both sides (above, right).

Replace Those Old Windows with New

Requiring no sash weights (or cords), weatherstripping, planing, or fitting, Nuprime replacement windows let you update worn-out double-hung wood windows quickly and easily. Made from aluminum extrusions, each window takes about 30 minutes to install—working entirely from the inside.

The windows feature spring-loaded sash balances that give full travel to both sashes, and positive tension that holds the sashes where you want them. Windows are available with double-insulated glass as an optional extra, but combination storm/screen units are recommended for cold climates. For your nearest Nuprime window dealer, write Season-All Industries, Inc., Indiana, Pa., 15701.



After measuring and cutting, exterior filler strip is installed on both sides for draft-free window fit.

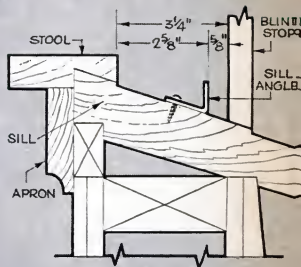
Products



Header expander (left) allows rough opening height to vary as much as $\frac{7}{8}$ "., permits easy installation from the inside. Frame is placed over sill angle



(center), located as shown in sketch. Expander is then pushed tight against top jamb and secured with screws. Prices vary with finish, average \$35



Frame is held by two $2\frac{1}{4}$ " screws on each side of jamb. Job is completed when inside stops are replaced against aluminum frame. Sash is easily re-



moved for cleaning both inside and outside glass surfaces from indoors. Completely weatherstripped, the windows are available in three finishes.

Spread a New Patio Surface

If you're planning to repave your patio—or any other clean, solid surface—take a look at a new topping material that combines epoxy resin with inert colored stone aggregates. Called Poradek/Ceramic Carpeting, it's a good-looking surface that, the manufacturer says, is impervious to wind, water, ice, and extreme temperatures. The maker claims, too, that it will outwear concrete or brick. And most important, you can install it yourself.

Unlike most topping materials, Poradek is not thickly applied. After spreading the paste with a rake, it is troweled to a uniform $\frac{1}{8}$ inch. Once it's down, there are no further steps. You don't have to grind or sand the surface, or apply any liquid sealers. Fast drying, a patio paved in the afternoon (in warm weather) can be used that evening. You've got a nonskid surface, too—great for pool decks.

The topping is sold in premeasured kits for treatment of six, 25, 50, and 100 square feet; they are priced at \$8.75, \$22.75,



Entire kit, packaged in largest can, includes granules, curing agent (smallest can), base resin, instructions, gloves. Kit covers 25 square feet.

\$39.75, and \$65 respectively. It's available in a wide variety of colors (with metallic glitter chips optional). For the location of the nearest dealer, write Resin Systems, Inc., 25-29 50 St., Woodside, N.Y. 11377.



Curing agent is emptied into base resin and mixed thoroughly to form epoxy matrix. When combined, chemical reaction starts. Job must keep moving; at 70 degrees you have about $\frac{1}{2}$ hour to work mix.



Epoxy is added to granules and the mixture is stirred until all granules are coated. A stick can be used, but a mixing device such as a Jiffy Mixer chucked in an electric drill saves your arms.



Mixed batch is dumped in center of area to be covered. If any granules are still dry, pile is worked with trowel. To insure raking paste thin enough, measure and mark off area that the kit should cover.



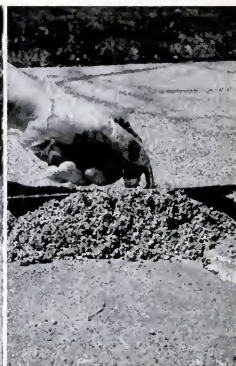
Topping looks like carpet, wears like concrete. Patio shown was finished by two men in a day.



Visible joint lines between batches are avoided by raking the new batch into the edge of the previous pour. Rake is a quick way to rough-spread the material, leaving you more time to do finish troweling.



To smooth mixture, the trowel is held with leading edge just above surface, used with steady downward pressure. To clean tools, scrape heavy accumulations off first, finish with turps or benzine.



Cracks, which must be cleaned of loose concrete, take considerable amount of material. To avoid running out, order at least 10 percent more than for area to be covered, to fill in low spots and cracks.

Loose-Lay Seamless Vinyl Flooring

Still another product has slipped from the professional's bag of tricks into the hands of the do-it-yourselfer. New from Armstrong Cork is an economical vinyl floor covering that you can install quickly and easily at any grade level without adhesives. Called Castilian, the floor covering is simply loose-laid over concrete, hardboard, or the old resilient floor, and the job is done.

The 12-foot width of the material reduces the number of seams in the finished floor; many rooms will have no seams at all. Because it can be installed directly over the old floor, you can do the job economically and in a matter of hours.

Available in a choice of colors in two designs at floor-covering dealers, Castilian is priced at about \$4.50 per square yard.



"Andrel," (above) is one of two designs offered in Armstrong Castilian. Made in six- and 12-foot widths, it is the first sheet vinyl recommended for installation without adhesive.



Line up straight edge of material with the longest wall in the room, allowing the excess to flash up the other three walls. Note how flooring material has been precut to fit around protruding cabinets.



First step in loose-laying vinyl is removal of the shoe molding. If this is removed carefully, it can be replaced after floor is down.



Measure room for length and width. For irregularly shaped, or out of square, rooms, take several measurements to minimize waste.



Transfer measurements of room to floor covering; snap chalk line three inches wider and longer than dimensions of the room.



Press flooring firmly into place. Trim with knife or scissors, allowing $\frac{1}{8}$ -inch clearance along walls. Cut vinyl face-up for clean cut.



At doorway, where flooring meets hardwood, material is trimmed flush with wood. Cement exposed edge, or cap with metal as shown.



Last step in loose-lay process is to replace shoe molding. Allowing a slight clearance above floor, nail molding to baseboard—not floor.

Install a Tile-Ceiling Light



1 Screw to the furring the adapter plate of a semirecessed fixture especially designed (by Armstrong Cork Co.) for suspended-tile ceilings.



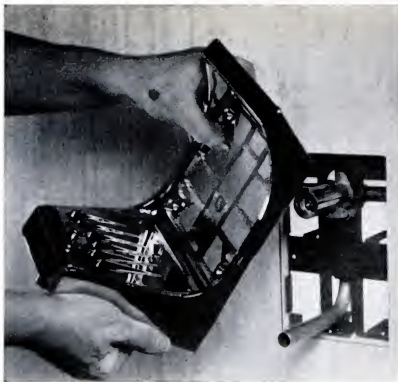
2 Clip junction box onto adapter plate and hook up socket to your house wiring. Notice how neatly 12"-by-12" fixture replaces one ceiling tile.



3 Snap reflector dome onto adapter plate—which fits into tongue-and-groove tiles that surround it. (Two sides were left open here for wiring.)



4 Snap-on lens frame of simulated wood grain is a snap to remove, too, for inserting 100-watt bulb. New fixture, called Tilemate, is \$10.50.



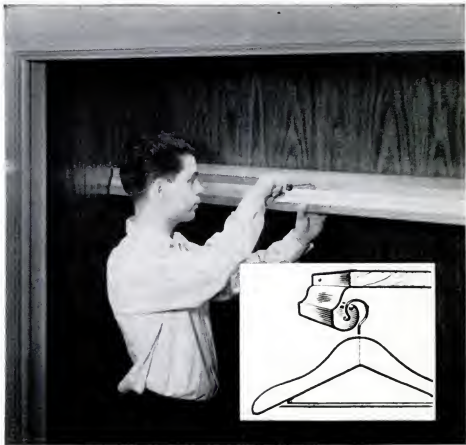
Put in a Modern Bath Fixture

It's a 5-in-1 unit for a tub shower: a hot-and-cold mixing faucet with a diverter to shower head, a grab bar, and a soap shelf. No wonder Moen (Elyria, Ohio 44036) punned a fancy name for it—Moenique. Installation is easy in new construction or when re-

modeling. You nail two perforated metal strips across two studs to take the mounting plate, and attach supply lines in back. After finish wall is in place (above, left) mount the fixture over control valve and spout tube, add the back plate and dial knob.

Replace That Ugly Old Closet Pole

Add an attractive modern look to a closet with this new kind of clothes bar. Just screw it to the edge of a new shelf or the one that's there. It costs less than a dollar a foot and you have a choice of brass or chrome-satin finish. From Alliance Metal Products, 11300 Schaefer Hwy, Detroit 48227.





First multicolor carpet suitable for exterior use is the claim made by Ozite for Garden Fiesta. The carpeting is made in two three-color combinations: avocado background with rust and charcoal green, and in two tones of rust plus avocado. It can be installed outdoors using two-faced tape or Ozite's AP-400 waterproof adhesive. Available in 12-foot widths, the carpeting sells for \$5.50 a square yard.

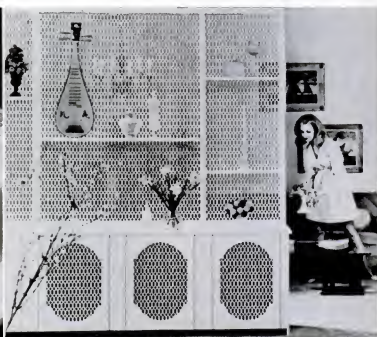


The bold look is evident in the "Dialogue 16" collection of wall coverings by Jack Denst Designs. A Dialogue of Color (shown above) is one of 12 designs that are silk-screened on silver foil, paper, and vinyl. Several of the designs use enamel inks to achieve a high gloss. The collection is marketed through interior designers and wall-covering dealers. Denst, 7355 S. Exchange Ave., Chicago 60649.

Other New Products



Cabinet-mounted lavatory by Crane does everything but shave you. Royale Console features include two hidden soap dishes (note one reflected in mirror), pushbuttons for regulating water temperature, and a swing spout with drinking-fountain bubbler. Bowl rises from 28 to 38 inches at button touch.



The Mediterranean theme is accented in Regency Filigree by Masonite. Self-ventilating, the panels are ideal for room dividers, cabinet doors, and portable screens. They come in four sizes, for use with accessories that include ready-grooved moldings, ceiling spring plungers, and bottom glides.



Deep embossing and wide random grooving give Armstrong Cork's rugged Woodstock paneling the appearance of hand-hewn aged wood. Made in four-by-eight-foot sheets, the 1/4-inch paneling is easy to install; it can be applied directly to studs, furring strips, plaster, or wallboard with nails or adhesives. It's sold through lumber dealers and building-supply stores. Price is \$10.95 a sheet.



Spanish Classic paneling has the look of authentic hand-rubbed wood, is actually self-sticking dimensional vinyl panels. Easy to maintain, they're washable, grease- and stain-resistant. Available at paint, hardware, and department stores, a box of six panels covers 12 square feet, costs \$3. There are also French Provincial and Colonial motifs. Decro-Wall Corp., Executive Blvd., Elmsford, N. Y. 10523.

for Home Remodeling



Preformed all-pitch flashings are designed to fit any chimney that protrudes through the slant side of a roof. They come in various sizes, and can be installed by mason, carpenter, or do-it-yourselfer in about 15 minutes. A paper template with instructions and roof-pitch markings is glued to each flashing side; sketch at left shows how it goes together. No soldering is required; interlocking seams are simply caulked. For nearest dealer, write Miller Metal Products Co., 1310 Edgewood Dr., Appleton, Wis. 54911.



Swinging mailbox support prevents missed mail because of high snow. The extended arm lets you set the post permanently away from the curb, leaving clearance for snow removal. It's convenient for the mailman, too. All metal parts are treated for weather resistance. The support can be adapted to fit all mailboxes. If the extension arm is hit, it swings aside and returns to its original position. It's fully adjustable in height to meet local mail and highway requirements. \$12.95, Plasti-Dip Corp., 6406 Cambridge St., Minneapolis 55426.

Family Learning



Basic box and shelf units are bolted between pairs of poles to create unit tailored to needs of your family. Top shelves have hairpin brackets that set into drilled holes to act as bookends.

Every type of study or hobby pursuit can be accommodated by this compact assembly. Two can use facilities at once, since typing table is separate. Desk

Choose from our blueprint the units you want and group them as you please

By MACK PHILIPS

One of the hottest ideas now promoted by home builders, architects, and educators is a new concept known as a family learning center—a wall or corner that brings together all the elements used in home study and provides an attractive, convenient place to use and store them.

POPULAR SCIENCE commissioned the design for such a center, based on the popular com-

top with extension leaf up is large enough for shell tray (left) or to support projector for showing slides on drop-down screen hinged to box or shelf (below).



Center You Design Yourself



ponent/suspension furniture system. Our thinking was that such a system offered the greatest flexibility for customizing a center to each family's special needs.

You may want to put it in a bedroom, family room, or den, or make it of cabinet hardwood for the living room.

All units are 30" wide, either 16" or 18" deep. The components are constructed similarly so you can "mass-produce" as many of each kind as you need. The basic boxes can be equipped with sliding doors of hardboard or glass, hinged doors with decorative moldings and pulls, or shallow drawers. The entire assembly is easily taken apart if you move.

A minimum of skill is required, all joints being butt, simple dado, or rabbit. The only mitering is on desk-top edging. Since exposed plywood edges will be covered with veneer tape, you can achieve a contemporary butt-joint appearance at the

bottom corners of the box units by running side tapes down to hide rabbets.

Basic study needs include: ample writing space, storage for reference books, plus a typing table—all provided with good light. You should also plan for storage and use of your particular learning materials and equipment. You might want to add stereo speakers, a small TV, facilities for learning from slide sets and filmstrips. Check your local Board of Education as to what materials are available. They may be able to put you onto special learn-at-home courses involving equipment for which you'll want to make provision.

If creative art or drafting is in your schedule, plan a special desk top, slanted like a drafting table.

Our pole, shelf, and box system is designed to cram the most into the smallest

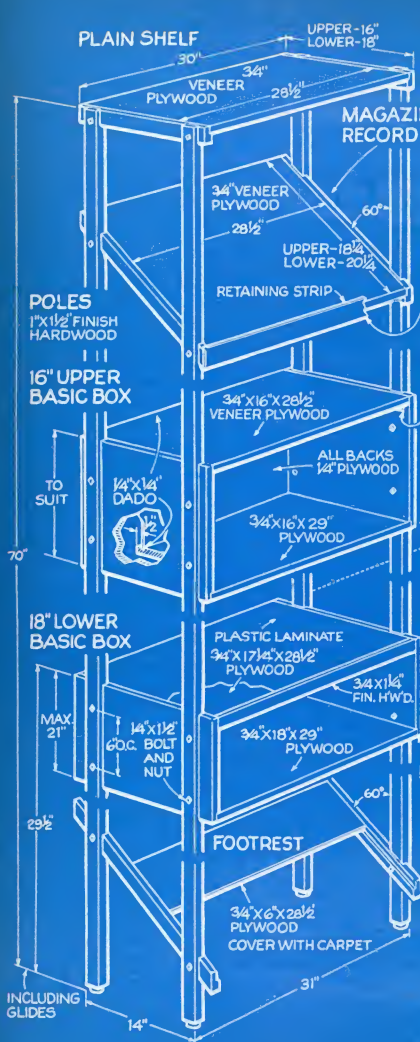
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Desk has three drawers. Shallow one, compartmented for pencils, stapler, stamps, has a waxed support strip on each side to slide on blocks fast-

ened inside knee well. To right is standard-depth drawer (closed) for stationery, plus file-depth drawer for storage of reference papers, correspondence.



Turn the
page for
lie-flat
blueprint



PROJECTION SCREEN



3/4" PIANO HINGE

1/8" x 14" x 21" HARDBOARD
 PAINT FLAT WHITE
 SLOT FOR TURNBUCKLE

DESK TOP
 30" x 60"

3/4" TRIANGULAR GUSSET STRIP
 TOP-SIDE JOINTS ALL BOX UNITS

1/4" x 1/4" DADO

1/4" x 19 1/4" x 29" PLYWOOD

34" x 18" x 29" VENEER PLYWOOD

1/4" x 1/4" DADO

19 3/4"

1/4" x 1/4" DADO

34" x 18" x 29" VENEER PLYWOOD

STORAGE UNIT

1/4" x 1/4" DADO

34" x 1/4" RABBET

UPPER-1" LOWER-2"

UPPER-16" LOWER-18"

1 1/2" x 1 1/2" DADO

14"

34" VENEER PLYWOOD

TYPICAL BOX END

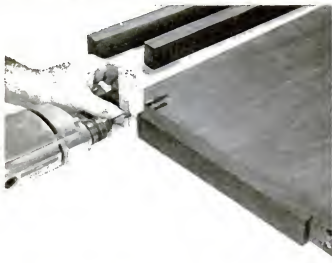
34" x 1/4" RABBET



Finish components before assembly. Easiest and best-looking finish for hardwood plywood is brush-on-wipe-off Danish oil. No topcoat is required.



Lighting for individual work areas can be built in. Underside of unit to which lamp attaches is surfaced with white laminate, as is back of plywood shield.



Templates speed work of notching and drilling, and assure alignment. Hardboard layout strips, right, locate all the dados identically. Block (in photo) is

space. The height is 70", and the minimum wall space required is 90", since no less than three sections (four pairs of poles) should be erected. One of these should include the desk, set in at right angles. This extends 60" from the wall, with a drop-leaf extension that increases the desk top to a full 6'.

All pole tops should be joined with shelves or box units. The base end of the poles should be jointed with box units, shelves, footrests, or spacer panels.

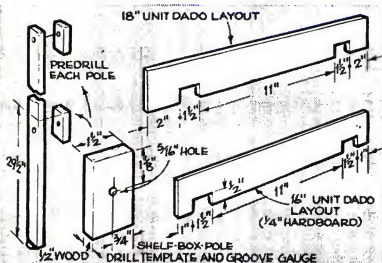
Making the layout. Use graph paper to sketch up a scale layout of the components you want for the wall space you can spare. Any three units, with a desk, can be free-standing, to serve as a room divider.

The basic material is $\frac{3}{4}$ " cabinet-grade plywood. It's impossible to list amounts you'll need since this will depend on the type and number of components you decide on. But as a rough estimate, about two-thirds of a 4'-by-8' sheet is required for the average 30"-by-70" section. You can cut costs by using fir plywood or particle-board for unseen sides and bases. In addition, you'll need matching $\frac{1}{4}$ " ply for back panels. Drawer sides and interior shelves are best made of $\frac{1}{2}$ " clear pine. Drawer bottoms and the projection screen are $\frac{1}{8}$ " tempered hardboard.

Some construction tips:

- Try a local millwork shop for straight planed-to-size poles. Or have your lumberyard rip $1\frac{1}{4}$ " strips from a seasoned 2" hardwood board, then finish-saw these to size on your table or radial saw. If 2"

[Continued on page 208]



dado depth and width gauge, and positions drill for assembly hole (here, through strip fastened at end of the shelf to permit bolting to the pole).



Today's learning involves complex audio-visual equipment, from tape deck (top left) to TV.



To bolt desk top to drawer case, recess six nuts into top face and predrill matching holes through false top of case before applying plastic laminate.



Strengthen posts that flank knee-space sections with angled footrests. If preferred, braces can be vertical panels, rabbeted and screwed to rear posts.

GUIDE TO HOME-IMPROVEMENT MATERIALS

*NEW PLYWOOD

The lowly softwoods have gone mod with color and texture, for the most varied — and cheapest — plywood paneling you can buy

By JACKSON HAND

The most glamorous names in prefinished paneling may be rosewood and teak, but some of the most beautiful new wall panels bear humble labels like cedar, pine, and fir. Often using the same production techniques and rugged factory-applied finishes they employ for hardwoods, the paneling manufacturers now give us softwoods ready to put up in sheet form. They're real wood — natural wood — and the prices are one-half to one-third what you'd spend for hardwood panels.

The latest varieties offer colors and textures that are undreamed of in hardwood. One reason is that producers feel a certain freedom in working with common domestic softwoods. They tend to treat walnut, for example, with the respect it deserves as a traditional cabinet wood. Pine, on the other hand, is cheap enough to monkey with —

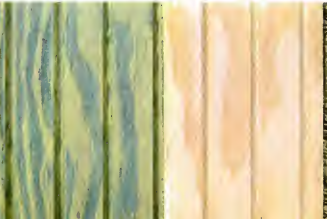
even if you happen to believe that plain, unadorned pine is still one of the loveliest woods in the world. This sense of freedom to experiment applies even more to fir, whose wild grain has long been considered a great disadvantage. Today, that grain pattern is often emphasized by abrading away the softer wood to form a deep texture, or by giving it a two-tone treatment.

The choices. Look what you can now find in prefinished softwood plywood:

- Pine stained non-wood colors — blue, green, orange — with all the good looks of the grain and the punctuation of pine knots. Such panels give you a chance to employ the beauty of wood in more and more locations, without risking the monotony of an overall brown tone. Non-wood colors combine well with color-selected paints and wallpapers, lending variety to wall treatments.

***FIR** Rough-sawn fir, prefinished for use as a siding, is shown as the background for these two pages. One of the newest ideas for interior paneling, it's available in a range of wood hues and colors. Another fir panel (below) is Weyer-

haeuser's 2-plus-2 Designer, shown clear and with a brush-and-wipe of green Rez. The textured fir (below) is one of several two-color combinations offered on U.S. Plywood's Surfwood panel. A major advantage of all these softwood panels is low cost.



By themselves, panels of this type can be the making of parts of the house that don't decorate easily, such as entryways, stair landings, and breakfast nooks.

- When you want the look of softwood planks, you get it in the form of plywood — prefinished or plain — which doesn't swell and shrink, leaving ugly cracks between boards. More than most other woods, pine and cedar plywoods come plank-sliced, which means the veneer is applied in random-width strips, with an interesting change in grain pattern from board to board. Sometimes the joints are emphasized by means of V grooves; sometimes the surface is plain, giving the look of edge-glued boards.

- Some of the most interesting textures of fir plywood, such as the Weldtex and Surfwood of U.S. Plywood, are available with finishes already applied.

- Adding cedar to the line of prefinished paneling (the example at right is Georgia-Pacific's knotty red) gives you another new color among the wood hues. It's a reddish brown, but there's a subtle bluish cast in many lights. So it combines well with cool colors and permits many contemporary effects that are difficult with traditional paneling.

- The relatively new idea of bringing prefinished exterior sidings indoors for use as paneling increases your choice still more. Rough-sawn or brushed fir, the industry's well-known Texture One-Eleven, reverse board-and-batten—all introduce textures and stripes and patterns that have never be-

Continued



***CEDAR** Relative newcomer to the field of prefinished paneling is knotty cedar, with a distinctive deep red-brown color that gives it richness of tone without need for staining. Above, Georgia-Pacific's V-groove plank.

***PINE** A favorite paneling material in tongue-and-groove form for many years, pine comes in sheets, far more stable, much easier to put up. Biggest feature of new pine paneling is new, non-wood colors, such as these from

General Plywood (Bluebell, left; Fern, right) which owe their clarity of color to the use of penetrating wood dyes rather than surface stains. These panels come with grooves to emphasize the plank effect. Or you can buy pine ply ungrooved and unfinished.





New installation idea for softwood panels: Paint wall between mounting frames of $\frac{3}{8}$ -inch plywood an accent color before applying panel adhesive.



Suspended effect is achieved when two-foot-wide plywood panels are applied so all edges overlap mounting frame. One nail at top and bottom anchors each.

fore been available. The choice widens if you include redwood and other siding materials that are not prefinished, and on which you can make use of the infinite color ranges of, for instance, Cabot's shingle stains. Taking the outdoor approach to finishing makes fast work of indoor paneling.

For matching: solid wood. A great feature of softwood plywood is the availability of solid wood to match it, for trim, built-ins, and other construction. When you work with many of the hardwood panels, matching solid woods aren't available, except on special order.

But you can walk into any lumberyard and pick up moldings of pine which—of course—match pine, but also take stains and finishes much like fir. Redwood lumber is readily available. In some areas, cedar is standard, and in any part of the country you can buy cedar in some form—such as four-by-fours, which you can cut into sizes to go with cedar paneling.

Special treatments. The ease with which solid woods can be bought leads you into a variety of special treatments:

- Rough-sawn battens, one-by-one in size, nailed vertically over a rough-sawn paneled wall, giving texture to a surface that would otherwise be of little interest.
- Moldings applied to paneled walls in the form of frames with mitered corners—a modern version of recessed panels.
- Stair treads to match paneling.
- Construction of wall storage units or shelves or cabinets to match the paneling—either from solid wood, or from $\frac{3}{4}$ -inch ply covered with the same face veneer.
- Matching-wood nailing strips, permitted to show as part of the wall design (a variation on the suspended-panel application, demonstrated at left in photos by the American Plywood Assn.).

And if the color you want isn't available in prefinished softwood paneling, you can handle the finishing yourself with a minimum of work. Such lines as Rez, Cabot, and Minwax offer a wide variety of stains. You can also regard any oil-base enamel as a stain if you thin it with a little Val-Oil, clear Firzite, or similar penetrating material. Except for areas of high traffic, no topcoat should be necessary. E



Paneling Can Cover the Door, Too

What do you do with the doors when you panel a room? If they happen to be the same wood as the paneling, you could take a crack at refinishing them to match. Or you could enamel them a complementary color.

General Plywood of Louisville, Ky., has a better idea: Panel the door with the same prefinished plywood you used on the walls. And to make the job easier, the company matches most of its regular paneling species and finishes with special sheets for interior doors.

These sheets for doors are 2'8" wide by 6'8" high—the right size for most standard doors. They are only $\frac{1}{8}$ " thick—which means that you don't have to reset the hinges or alter the stops. This thickness is recommended only for flush doors. If you want to cover a recessed-panel type, you should use a regular $\frac{1}{4}$ " panel.

As in any sheet-laminating process, the best adhesive is contact cement, applied to both surfaces. The basic steps are covered in the photos at right.

One additional hint: When the cement has dried on both surfaces, cover the door with sheets of newspaper, overlapped slightly. Lay the plywood atop the paper, aligned so that it projects past all four edges. Then, gently slide one of the sheets back to expose a strip down one side of the door. Firm down the panel on the exposed area. This holds it in place while you remove each remaining sheet, pounding down the panel with the heel of your hand as you slide the paper out. ■



To get door into position where you can work on it, pull the hinge pins and lay the door across saw horses—or on a well-protected dining-room table.



Position the sheet carefully, after coating its back and face of door with cement. Firm down all over, trim any excess flush with edges, and rehang door.





The Basement with Movable Walls

Accordion-fold partitions transform a utility area into a glamorous party room

By **KARL KEELER JR.**
as told to **AL LEES**

It all began when we bought that pool table. Suddenly the social focus of our home shifted to the cellar. When our friends (or pals of our teen-age children) dropped in, they soon gravitated to the ugliest room in the house to shoot a few rounds. It was, frankly, an embarrassment to us all—especially when we threw parties. My wife would knock herself out getting the upstairs in just the right festive mood, only to lose her guests to a basement that was a combination laun-

dry, furnace room, and workshop, “decorated” with a jumble of out-of-season items (sleds in summer, lawn chairs in winter).

Her foot came down firmly, at last: “Either we provide a decent setting for that pool table, or out it goes.”

I was too hooked on the game to consider the second alternative, so I pondered the problem most home owners face: how to glamorize the basement without compromising its essential functions. The laundry, workshop, and furnace had to stay—as did some of the stored items. What we really needed was an “instant basement”—a party room that could be quickly converted back into a workroom.

Folding partitions were obviously the answer; if I got the prefinished wood type, they’d match up with the wall paneling I wanted, and give the party room a luxurious unity.

Continued



BEFORE

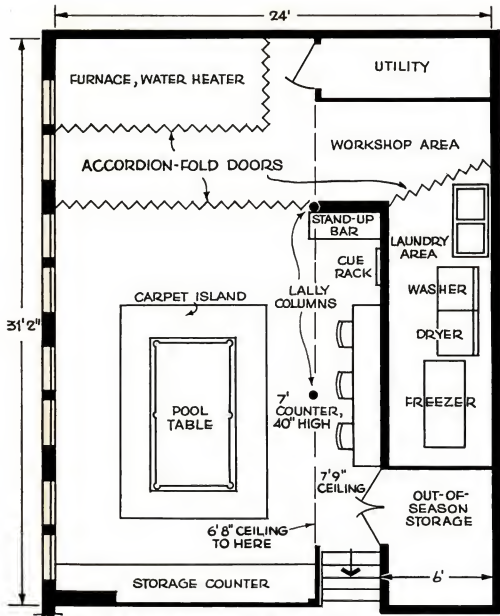
Hopeless one-room basement was storage catchall. Because work areas were undefined, out-of-season items soon gathered to form barriers. It took longer to clear space in workshop (left) than to do the work. Shop was spattered by laundry, laundry was showered with sawdust. And when furnace or water heater (right) needed attention, the route was an obstacle course.



AFTER

It's the same room—honest! Note two columns in photo on facing page. Forward one is now sheathed with Ozite to match carpet beneath billiard table. Rear one is enclosed in wall of stand-up bar (below, right). Utility areas are now out of sight but accessible. Fixed L partition and bar (both covered with Royalcote Shale White panels) plus Woodfold accordion door create party room, lighted by Cue Master double-dome, Lightolier's adjustable-track bullets (right), and recessed spots (far left). Entry wall (below, left) is paneled with Masonite's Living Wall for shelf support; doors of Marlite-topped counter are Peg-Board and Presdwood.





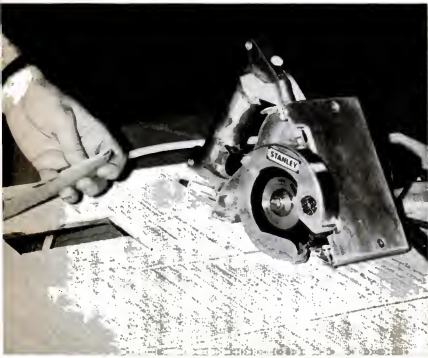
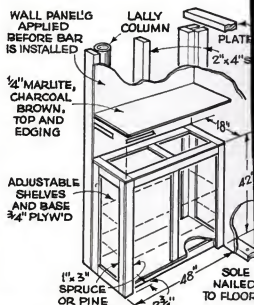
Added partitions—folding and permanent—divide space into areas for specific uses. Main accordion-fold closes against bar (plans, right) to shut party room off from work areas. If party grows, this door folds against wall, adding space. Partition between workshop and laundry—angled to miss existing tubs—folds back for more elbow room.

Paneling is cinch to cut with Stanley's new Eager Beaver saw equipped with Teflon-S-coated blade. At left, four pocket cuts make opening for electrical outlet. At right, door opening is cut after panel

is installed. After opening is framed, cut-out piece will be hinged in place for "invisible" door. Reversible blade and double shoe let you cut backward, forward, right or left, snug to wall or floor.



Old entry's open railing and exposed I beam caused tall guests to duck. New stub partition (see previous page) plus stepped ceiling solves problem.





Suspended-grid ceiling goes up after paneling is in place. U.S. Gypsum's Quietone System consists of parallel metal T strips hung on wires (above left) below lowest point of furnace ducts to allow for inserting two-by-four-foot acoustical panels. Cross T strips snap between these. At ends, grid is supported by L strips nailed to paneling (right). Moldings at inside and outside corners are added last. Grid is checked with level as it's installed.

I sat down with graph paper and scaled out a floor plan (far left). I altered nothing of the original layout, merely adding one stationary partition and several movable ones.

Merely. It's easy on paper. As you can see from the "before" photos, our basement presented the usual problems—exposed furnace ducts and an I beam that would have to be hidden by a suspended ceiling. Yet folding partitions hang from overhead tracks—they don't touch the floor—so I had to mount the tracks in a way that could support this weight (10 pounds per running foot). What I did was fasten the tracks to the exposed joists, blocking them down to ceiling level—then I just butted the finish ceiling up against them.

Another problem: The permanent partition cut down the laundry work space. Add a low ceiling and you'd risk claustrophobia. So I dropped the ceiling only in the spa-

Continued

Each block of four 12-by-12-inch tiles is framed with half-inch feature strips pressed into troweled adhesive. To give illusion of wider room, dark-brown strips were run across width, light-brown strips down length of room. This is new Aegean Stone vinyl asbestos flooring by Azrock



Accordion door tracks around furnace area were mounted on two-by-fours nailed to floor joists. Corner joint fell beneath cold-air return duct, so was anchored with sheet-metal screws through steel angle.



Main movable wall butts against bar partition (workshop side at left, above), and track—again screwed to two-by-fours nailed across joists—interrupts ceiling. Finished effect (below) is achieved by nailing strips of acoustical panel along each side.





Exposed lally column is wrapped with a single strip of Ozite Town-Aire carpet, held in place with double-faced tape applied around pole at 16-inch intervals and up side where butting edges meet (left). Overnight binding with twine assures good adhesion.

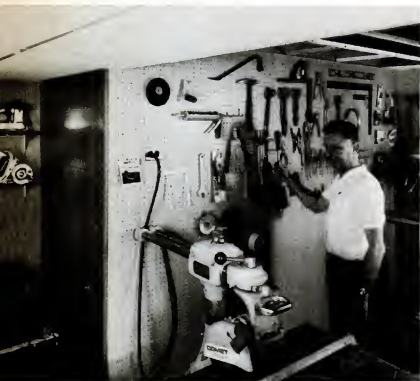
cious part of the basement where clearance of the ducts required it. A two-level ceiling complicated my grid system, since it called for a vertical fill-in; but as you can see from the main color photo, we got a bonus by extending the higher ceiling past the partition to line up with the entry stairs. This way, we don't feel we have to duck as we come down.

This also let me light that texture-paneled feature wall along the snack counter with an ingenious system of bullet spots that can be grouped anywhere along a track as needed. The Lytespan track mounts on the ceiling (as seen in the background of the photos at top left) and is controlled by a wall switch. Each of the bullets turns on and off independently—or can even be removed from the track.

But all this was far in the future when I began. More mundane jobs came first—such as wrapping the overhead cold-water pipes with no-drip tape so condensation wouldn't stain the suspended ceiling. And furring the foundation walls with one-by-three strips on 16-inch centers. To make certain these strips were plumb, I set them in a fat bead of Masonite's Royalcote adhesive, shimming them as needed before the bead set.

I'd already decided that to speed the job and assure low maintenance, I'd stick to prefinished materials. I wanted several of the walls to take adjustable shelves, so

[\[Continued on page 198\]](#)



Working walls of workshop (left) store tools on Peg-Board hooks and on adjustable shelves bracketed into Living Wall. Woodfold Series 200 Utility Door separates shop from laundry (below). Set at angle, track has curved ends for tight closure (below left).



The first cosmetic for walls.

Dutch Boy®Nalplex® is a superb cosmetic for walls...it's the latex flat wall finish that helps you create beautiful rooms.

Odorless Nalplex has great hiding power that makes one coat look like two. There's beauty in every smooth stroke. Nalplex dries quickly to a beautiful finish that stays perfect.

And it's the wall cosmetic that's on to stay, washing after washing. Yet, plain soap and water cleans up anything you weren't planning on painting.

The beauty of Dutch Boy Nalplex is the beautiful things it does for your walls. And the way it makes painting pleasant. For the finishing touch, use Dutch Boy Latex Satin Gloss Enamel in matching colors.

Dutch Boy Nalplex Latex Flat Wall Finish, the first cosmetic for walls.



Dutch Boy Nalplex

LATEX FLAT WALL FINISH

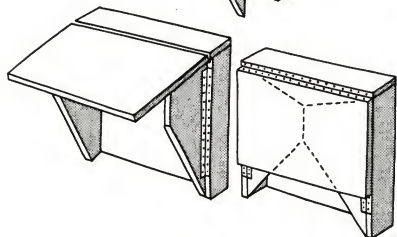
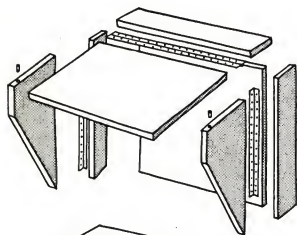
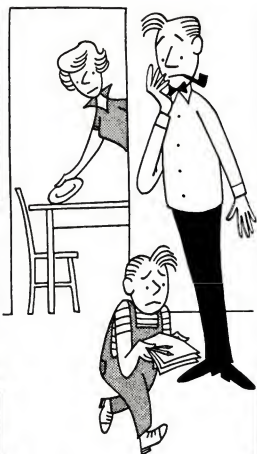
DUTCH BOY PAINTS
National Lead
Paint Company



If there's quality on the inside... there's a Dutch Boy on the outside.

Wordless Workshop

By ROY DOTY



It's easy to convert your basement to 'family living' with versatile Masonite products.



The newest member of the Royalcote paneling family features a beautiful embossed texture that you can see and feel. Ideal for informal living, Royalcote textured panels come in a choice of popular colors.



Royalcote Living Wall . . . a unique concept in decorative wall paneling—beautiful and functional, but with an important difference: Hidden slots in the grooves hold shelf brackets and picture hooks . . . high up or low down. Change them in seconds. No nails, screws, standards or drilling.

Masonite, Royalcote and Peg-Board are registered trademarks of Masonite Corporation.



You can put your basement walls to work and organize your work areas quickly and easily with Peg-Board and dozens of handy fixtures. Available in $\frac{1}{8}$ " and $\frac{1}{4}$ " thicknesses, Peg-Board is also ideal for garages or utility rooms.

There is no limit to the uses of Masonite hard-board products . . . walls, sliding doors, counter tops, what-have-you. These panels won't split, splinter or check. They go up fast with adhesive or nails on studs or furring strips. For more information send in the coupon.

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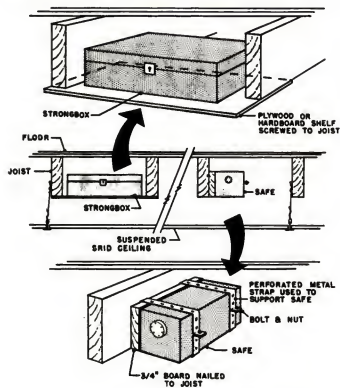
Shop Talk

By ROBERT P. STEVENSON

The easy way to put sliding doors on existing shelves

One of the handiest home-improvement products I've heard of lately is an extruded polyvinyl sliding-door track from Gossen Corp., 2040 W. Bender Rd., Milwaukee 53209—makers of a variety of plastic moldings. Slip it on the front edge of existing $\frac{3}{4}$ " shelves, nail or glue it, and you can install $\frac{1}{4}$ "-thick sliding doors cut to fit the space. Write to Gossen for information and prices on Snap-a-Track.

Want to safeguard some valuables? Hide them in a drop ceiling



Long, long ago some people socked away their valuables by pulling up a floorboard. Later, the movies made it fashionable to place a home safe behind a picture on the wall. Now there's a new idea—and not a bad one, either: Hide a safe or strongbox in a suspended-grid ceiling. The sketch shows how. Conwed Corp, which makes suspended ceilings, offers more information if you want it. Write to them at 332 Minnesota St., St. Paul, Minn. 55101.

News about fire-retardant paints

Two major paint companies have just announced new fire-retardant paints for interior use, both of them water-based. PPG Industries says that when flame is applied to its Speedhide fire-retardant latex paint the film forms foam "hundreds of times thicker" than the original paint film. "When the foam is charred and becomes rigid, it is not readily consumed by continued exposure to flames," the statement adds. A new paint from Martin-Senour reacts in the same way. "When attacked by fire," the company says, "it foams and forms an insulating barrier which prevents the surface from igniting, and confines the fire to its point of origin." Both paints are approved by the Underwriters Laboratories. Various colors are available.

Products that will help you in your home-improvement chores

You can make your own Tiffany-style hanging lamps with kits of stained glass and other parts, available from Lake Shore Glass Co., 739 N. Wells, Chicago 60610. Kit prices range from \$19.95 to \$46.95 . . . The cover of a replacement toilet seat has what appears to be a cane panel. Actually, the "cane" is made of vinyl. The maker: Bemis Mfg. Co., Sheboygan Falls, Wis. 53085 . . . Like Spanish Mediterranean lighting fixtures? Emerson Electric has a new line in this style. For information, write Station 2545, Emerson Electric, 8100 Florissant Ave., St. Louis 63136 . . . Stanley's two-way shelf brackets go either above or below the shelves. Above, they support the shelf and act as bookends at the same time. You can buy them at hardware stores.

After work, maybe you'd like to spend some time with the boys.

This man found a good answer. He was looking for a way to keep using the skills he learned in the service. Didn't want to waste that valuable experience.

His answer? The Air Force Reserve. That's right. Successful civilian though he is, he didn't hang up his flying suit for good.

No sir! He enjoys the best of

two lives now...civilian and Air Force! As part of an aircrew, he flies the world over with his Air Force buddies. Shares excitement and challenge.

And he's building a future for himself and his country. After work, think about it...maybe you'd like to spend some time with the boys in the Air Force Reserve.



Hq AF Reserve (PRP)

Robins AFB, Ga. 31093

Please send me information about joining the Air Force Reserve.

I was a member of the

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I understand there is no obligation.

PS-89





Easily adapted to vise jaws, aluminum Vice Caps eliminate mark-off and scratches on round or flat vise-held brass, copper, and aluminum. \$1.98 a set, the six-inch caps are made by Metronics Corp., Box 405, Hayward Rd., Frederick, Md. 21701.



Smooth and easy cutting through green or wet wood is what you get with H. K. Porter's newest Disston bow saw. The blade of the pruning tool is coated with slick Teflon-S. In three sizes—21, 30, and 36 inches—at \$4, \$5, and \$6 at hardware stores.

NEW HOME- IMPROVEMENT TOOLS



Ideal for work in close quarters: Each precision plier in this five-piece set from Sears has a removable spring that holds the jaws open when pressure is not applied. With plastic roll-up pouch, \$12.

You can bend copper and brass tubing—up to 5/16 inch in diameter—without kinks, using a tube bender like that below. The Akuret, made by Kastar, Bellport, N. Y. 11713, is \$1.65 at auto stores.



T-handle wrenches for socket-head screws are marketed by Hunter Tools in 10 sizes (3/32 to 3/8 inch) and three lengths (three, six, and nine inches). Prices run from 34 cents to \$1.80 apiece.



Discover for yourself how easily you can prepare in your spare time, at home, for an exciting high-pay career in today's "blue-chip" profession... Electronics

ARE YOU fed up with being stuck in a dull, routine job that pays peanuts? If so, here's your opportunity to get out of "dead end" work for good—and to start on the road to an exciting, high-pay career.

As you read this, there are thousands of career openings waiting for qualified men in today's big "growth" profession—Electronics. With training, you can be one of these men. You can have your pick of "glamor" jobs any man would be proud of—in TV and radio broadcasting, automation, the aerospace program.

And as you move up the ladder in this booming field, you can earn the kind of money many men only dream of: \$5, \$6, \$7 an hour... \$200, \$225, \$250 a week... \$10,000, \$11,000, even \$12,000 a year!

Getting the training you need to break into this field is easier than you might have thought possible. You don't need college—or even a high-

school diploma. As a matter of fact, you can prepare right at home, in your spare time.

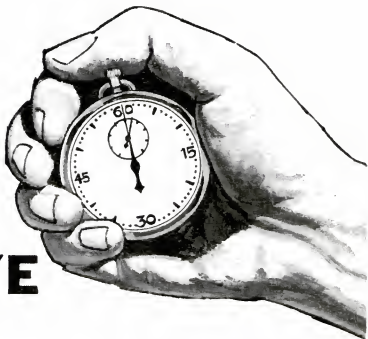
Want full details? Just mail us the bound-in postpaid card. We'll send you 2 FREE books that tell about career opportunities in Electronics and how you can prepare to cash in on them. Why not take the first step on the road to success by mailing the card right now? If card has been removed, send your name and address to CIE at the address below.

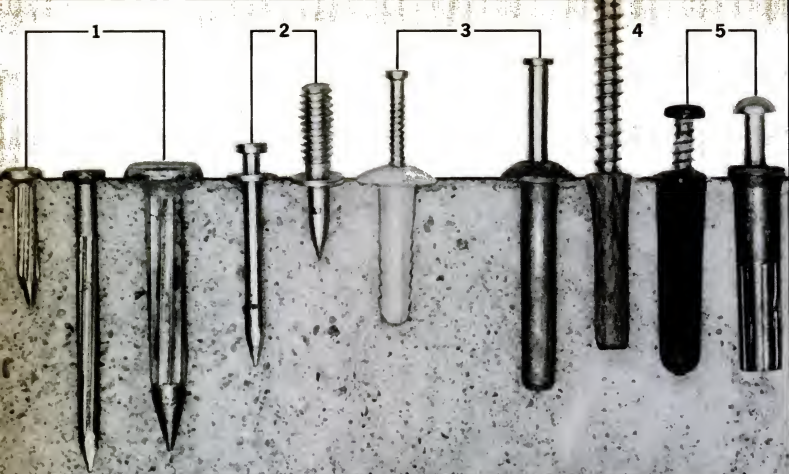
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Accredited Member National Home Study Council

**Now! In just
2 minutes,
find out
how you can
SAY GOODBYE
FOREVER TO
DULL, LOW-PAY WORK**





Concrete fasteners are shown actual size in approximate order of holding strength (weakest to strongest): 1. Masonry nails (use 20-ounce hammer; strike nail-head squarely). 2. Masonry pins (holding strength

similar to nails). 3. Nail anchors, nylon and steel. 4. Jute-fiber anchor (holds strongly when screw hole and anchor are same size). 5. Wood-screw anchors, plastic and lead. 6. Calk anchor (see installation



IMPROVE YOUR HOME

How to Fasten

Start with the right fastener, install it properly—and the fixture stays where it's put

By **HARRY WICKS**

PHOTOS BY ORLANDO GUERRA

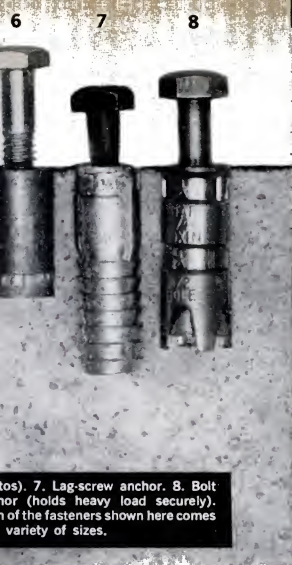
Not too long ago you didn't have much choice when you wanted to fasten something to masonry. After punching a hole, you slipped in a wood plug and fastened the fixture with a wood screw. Then you hoped for the best.

Not so, any more. Today a variety of fasteners are available for all types of masonry. And you don't have to buy or rent expensive equipment to use them. Several new tools, specially designed for

masonry fastening, are priced low enough so any home owner can buy one or more for his toolbox.

Most of the fasteners you are likely to use require a predrilled hole. This sets up an unbreakable rule: The hole must be the exact size needed. You can punch small holes in soft masonry using hand drills (popularly called star drills) or percussion drills. For big jobs, or if you want to make a lot of holes fast, an electric drill and carbide-tipped rotary bits are best.

Drilling masonry. The right way to drill masonry is to start small and work up to finish size in several steps. For example, if a 1/2-inch hole is wanted, start by drilling a 1/4-inch hole, enlarge it with a 3/8-inch drill, and finish with the half-inch. The job goes easier, the hole will be neat, and cutting edges last longer.



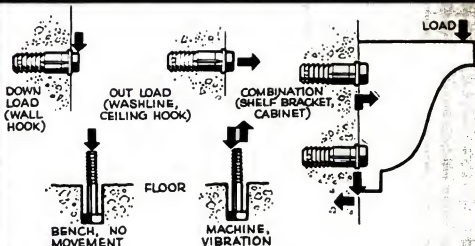
6. Toggle bolt. 7. Lag-screw anchor. 8. Bolt (holds heavy load securely). The variety of the fasteners shown here comes in a variety of sizes.

TYPES OF MASONRY

Common types of masonry in approximate order of anchoring strength, assuming good materials and workmanship.

Solid Concrete	Walls, floors, driveways, etc.; holds anchors best
Concrete Block	Fairly strong holding power if well made. Some have core walls too thin to take long anchors.
Cinder Block	Considerably softer and weaker than concrete block.
Brick Veneer	Carries light to moderate load; anchors preferably placed in mortar and positioned in hole to expand against bricks.
Stone Veneer	Strength similar to brick veneer.
Stucco	Holds light loads only.
Marble, Terrazzo, Ceramic Tile	Usually thin and brittle; carries light loads only. Drill carefully.

LOAD PROBLEMS



Anything to Concrete

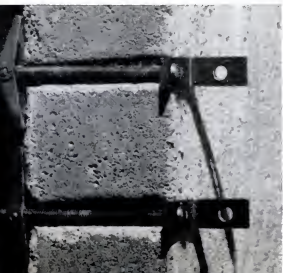
When drilling by hand with a hammer-driven percussion drill, "jump" the drill, lifting it slightly off the bottom of the hole—don't push it into the hole while hitting it. Keep the drill perpendicular to the masonry and constantly rotate it to keep it from locking in the hole.

Keep your drills sharp. The duller the drill, the tougher the drilling operation.

Also, as the cutting edges dull, outside diameter wears down; the result is under-size holes.

When drilling with power, carbide-tipped rotary drills, as a general rule, should be used at slow speed with maximum pressure. High speeds burn the drill; light pressure allows the point to "ride" the bottom of the hole instead of

Continued



Toggle bolts at left are best for anchoring to hollow masonry. When screw is turned all the way in, wings flatten on wall, distribute stress. Advantage: Bolt can be quickly retightened if vibration causes loosening.

Masonry pins are driven with holder that saves fingers (several available; Householder by Star, \$4, shown). Pin is placed in tool and plunger struck with hammer to seat it. Pins are for light loads to be held in solid concrete.



cutting. Don't let the drill overheat. Back it out occasionally to let it cool or keep it constantly wet. If the carbide drill rides a piece of aggregate, a few hard raps with a hammer and a percussion drill will break the stone and allow the tool to go through easily.

Methods of fastening. There are now several types of masonry nails besides the familiar square-cut ones. For some jobs—nailing a soleplate to a basement floor, for example—they work fine. They're not meant for (and shouldn't be used) where ability to hold weight is important. A safety must: Always wear shatterproof glasses when you drive them. A crooked shot with the hammer can cause them to break and ricochet about the room like shrapnel.

Several manufacturers market special holders for use with masonry pins. With these there is less chance of breaking or bending the fastener. Also, the grip is designed with a flared end to save bruised knuckles should the hammer miss or glance off the drive pin.

Embedment is a method of burying a fastener in fresh concrete. You drill or chisel out a hole to accept the fastening device, insert it, and pour patching cement around it.

There are several patching cements available that set rock-hard in a couple of hours; these eliminate the week you would have to wait (for curing) if ordinary concrete were used. Patching cement can be found at hardware and building-supply dealers under such brand names as Rockite, Fast Patch, etc.

Anchors. These offer the most versatile method of fastening to masonry. You can select anchors to carry a few pounds or hundreds of pounds (if the wall will carry the weight). And they can be used on walls or ceilings.

Which anchor to use? There are two rules of thumb to help you select the right one. As can be seen in the "Types of Masonry" chart, solid concrete is best for anchoring. But all concrete is not alike; the degree of hardness varies. You'll quickly find out how hard it is by the degree of resistance your drill meets. This sets up rule number one: The softer the masonry, the greater the size or length of anchor you need, or the stronger the type of anchor.

The load an anchor carries frequently involves more than just the fixture's weight. Use the "Load Problems" chart to determine which forces will be in play on a particular anchor. Thus the second



Use the right hammer with hand drills. One too heavy for small bits will bend them; one too light for larger drills won't deliver enough muscle, will simply bounce off.

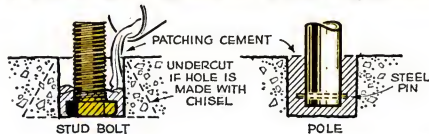


Percussion drills, from Rawlplug Co., do a precision job. Grip and drill holder (about \$5) prevent bashed fingers. Twist or straight flute drills cost 96 cents to \$5.



Fast-spiral and deep-flute drills are used in concrete; core drill for brittle masonry. Use cent punch first to prevent drift, 500 to 700 r.p.m. with carbide drill.

Four methods of embedment, a strong fastening technique



rule is: Consider the type of load. For example, as anchor size increases, so does the bolt, pin, or screw. If shear is the primary concern, play it safe by using a hefty bolt and anchor. If there will be tension on the fastener, resistance to pull-out must be considered. Ability to create friction is what determines an anchor's holding power.

Toggle bolts are the best fasteners to use on thin or hollow walls (concrete block, for example). With these, the hole is drilled large enough to allow the wings to pass through easily. Unlike anchors, toggle bolts are installed with the fixture on the bolt. **23**

New fast-setting patch cements make embedment in existing concrete (sketches, top) a quick job. On new work (right) anchor bolt was pushed into concrete before it set up.



Calk anchor is inserted cone-end-first into hole drilled to take anchor snugly in diameter and depth. Special tool for setting it (foreground), made by Rawplug, is included in each box of anchors. When the lead sleeve is calked (struck, photo right)



it wedges between the threaded cone and masonry. If masonry is soft or weak, anchor should be countersunk slightly below the surface. Machine screw used with anchor should engage about two-thirds of the thread in the cone, after fixture is in.

Five Good Storage

Where do you store out-of-season clothing? Or extra dishes? Or items that are used just once in a while? If you're short on storage space, as most families are, chances are that extra gear is packed away in a carton *somewhere* in the attic or basement.

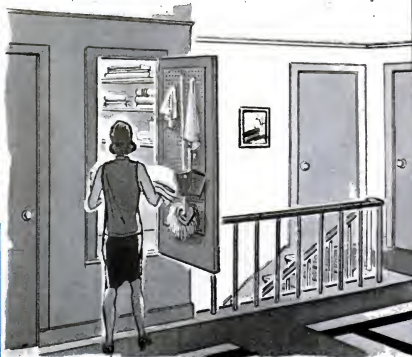
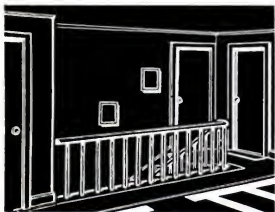
Though you may have been tempted to pick up and move, that isn't always the answer. Many larger homes with lots of floor space lack sufficient closet area. A more practical approach is to look around your present home for sites for built-in closets. All homes have such spots; it's just a matter of recognizing them.

Shown here are five ideas for pinpointing and using these areas. One or more of the ideas may fit in with your needs and floor plan. Others may require some custom-tailoring to suit the space you have available. But all five will help you turn your imagination loose in your search for storage space.

Continued



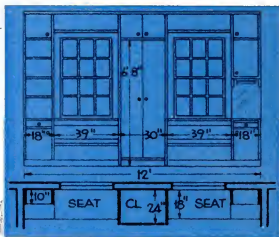
1 Wall space between windows was too narrow for a piece of furniture; as a result, the wall in this 12-foot bedroom was being wasted. By adding a floor-to-ceiling built-in, it was put to use. Unit includes bookcases and storage cabinet on the left; seats below each window; a narrow supplementary clothes closet in the center; and at right, a lighted dressing table with glove drawer and shoe cabinet below the pull-out shelf, and more storage cabinets above the mirror. Note: If radiators are below windows, seats should be vented with grille.



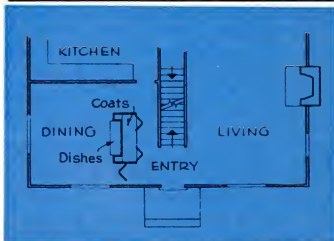
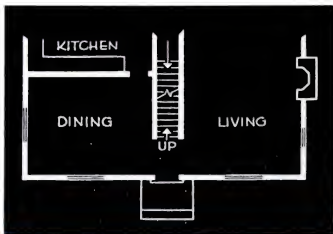
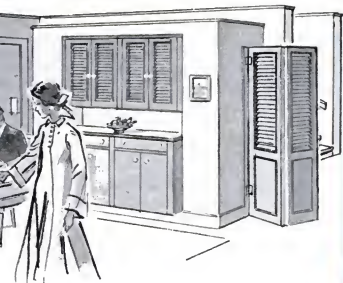
2 Straight-run stairway from first to second floor usually provides space for a small closet with a raised floor. Ceiling over the stairs is extended, with care taken to maintain required head room, and the closet is built within the addition. Supporting two-by-four framework is tied into studs in the far wall, fastened to floor on the near side. Closet shown can be used for seasonal storage or, with shelves added, for towels, linens, and bathroom supplies.

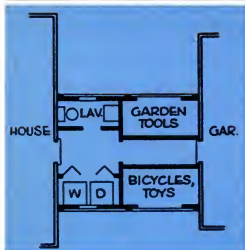
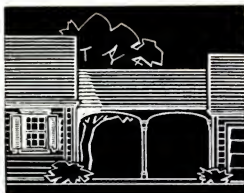
Ideas

By CARL SIGMAN
DRAWINGS BY SIGMAN WARD INC.

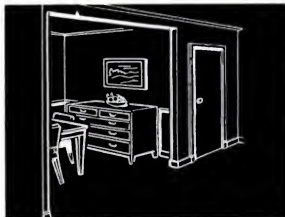


3 Most center-hall homes, with living and dining rooms flanking front door, lack an entryway closet. Also, traffic to the kitchen may have to pass through the dining area. By building the coat closet into an island, it becomes a room divider that creates a hallway to the kitchen. The closet shown was built extra deep, fitted to serve as a china cabinet/buffet on the dining-room side. Shelves above hold dishes; those below are used for linens and silverware. Louvered bifold door between closet and outside wall adds to dining privacy, doubles as wind screen when front door is opened.





4 A breezeway can be used to give the entire family storage relief—without sacrificing its basic function of providing a covered walk from garage to house. Here, a 13'-by-16' space contains two closets (for bicycles, garden equipment), a lavatory, and laundry center. Since floor, ceiling, and structural members are already there, construction simply requires standard wall framing. Exterior door sizes are determined by openings; outside wall covering should blend with house



5 Buffet-server combinations found in many "apartment size" dining sets frequently fail to provide adequate storage for all dining accessories. Try this, instead: a 36"-high wall-to-wall base cabinet to store linens and silverware; cabinets above to hold china and glassware. Though secured to wall studs with $2\frac{1}{2}$ " screws, hanging cabinet's weight-holding capacity should be beefed up by fastening to one-by-two cleat spiked to ceiling joists. Decorative doors add style.

One point to keep in mind when selecting a closet location: What will it hold? If the stored items are to be used daily, the closet should be conveniently accessible (Idea 3, for example). Storage closets for seasonal or little-used items can be located to utilize out-of-the-way, less-convenient space.

Recommended construction for all units shown is of $\frac{3}{4}$ " plywood over two-by-four framing. Cabinet-door treatment can be decorative (with louvers, glass, or cloth inside a frame) or practical (solid, with perforated hardboard inside for hanging small items). If space is narrow, use sliding—not hinged—doors. **13**



Ferro-Cement Furniture: Build It to Last Forever

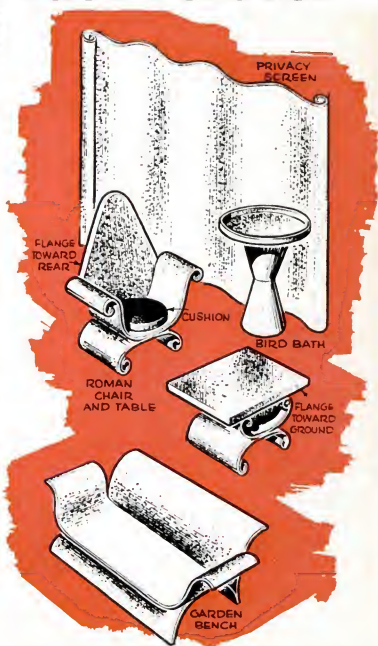
Shapes you can't make of wood or metal are easy—and cheap—with rugged thin-shell cement

By RICHARD DAY

Everyone knows you have to build concrete at least two inches thick to get any strength out of it. Or do you? Not with ferro-cement. That's the name given to a thin slab of mortar reinforced with layers of mesh and thin steel rods. Ferro-cement may be only a fraction of an inch thick yet be as strong as wood of the same cross section. No forms are needed.

Ferro-cement's secret was discovered some years ago by Italian architect Pier Luigi Nervi. He named it, and first used it to build roofs on huge buildings without using wooden forms. He then persuaded skeptical boatbuilders to try ferro-cement for hulls. Now it's the hottest thing in boat construction. And it's only $\frac{5}{8}$ " thick at some points on these hulls.

Continued





Forming the base of the planter table

1. Fold metal lath over strip of $\frac{1}{4}$ " plywood to form each of four 16"-by-47" base panels, double-thick.

2. Form end rolls by bending both thicknesses of lath around $1\frac{1}{2}$ " pipe, wearing heavy leather gloves.

3. Bend curves in both ends of each $\frac{1}{4}$ "-by-48" rod by inserting rod through $\frac{3}{8}$ " hole in heavy metal bar. Diameter: $2\frac{5}{8}$ ". Share one rod, use it as template.



7. Grout scrolls by applying mortar by hand, forcing it into mesh with finger pressure. First check that no cut ends of lath are sticking out to snag fingers. Stroke smooth.

8. Finish edges by packing grout in with fingers; it's impossible to do smooth job with trowel. Object is to leave no mesh exposed. Edging must be done soon as possible.

9. Cover grouted base with polyethylene to damp-cure it for at least six days. If it dries out during this time, strength will be diminished. Moisten if necessary.



13. Attach rim strips with wire loops through flange and top disk, twisted tight with pliers. Add identical strips to edges of inside cutout.

14. Dump mortar onto saucer of top reinforcement, placed on sheet of polyethylene on flat surface. Spread with trowel, work into mesh.

15. Grout the rim by backing it with concrete float. As you force mortar into mesh, move back trowel and float around rim.



4. Wire scroll panel to the inside curve of the reinforcing rod with loops of wire twisted tight with pliers. Wire an identical rod along the opposite edge, as well.



5. Assemble scroll panels by putting them together on flat surface and wiring all meeting points securely. Mix your cement, using packaged sand mix for mortar.



6. Spread mortar on each panel from bottom up, using flexible broad knife. Keep mix as stiff as you can trowel and work it into every diamond of lath.



Adding the top and applying the finish

10. Scribe circle for top on double sheet of lath, pieced out with wired-in scraps. String radius: 23½".



11. Mark interior cutout for planter well by placing lath disk atop curing base. Cut out with snips.



12. For table rim, use scraps folded into three layers 2½" wide. Lay strip of plywood on top, bend up a 1" flange along one edge. Then walk on plywood to flatten lath.



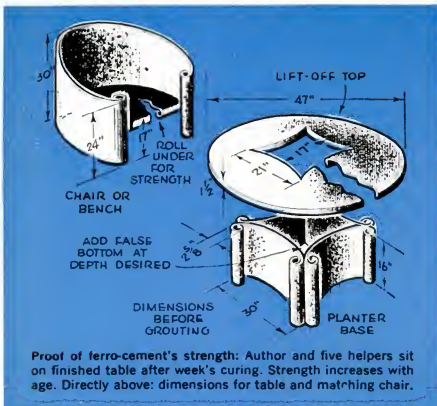
16. Brush on neat cement paste for bond when parts have set up; coat at once with thin sand-mix topping, colored if desired. Cure.



17. Travertine finish is achieved by swirling fingers through topping; coat then troweling lightly. This texturing adds interest to surface.



18. Place top on base when fully cured. It weighs only 75 pounds, but large diameter makes lifting—and storing, too—a two-man job.



You can explore the ferro-cement technique by building thin-shell outdoor furniture that'll be the talk of the neighborhood. You'll be pioneering—as I was. **POPULAR SCIENCE** asked me to develop a ferro-cement system readers could use. The step-by-step photos on the previous pages demonstrate the results—as applied to the construction of the planter table sketched above. As far as we know, this is the first time directions for making home projects out of ferro-cement have ever been published.

There's no wood anywhere in a ferro-

cement project—nothing to rot, repaint, or maintain. You just make a cage of twin layers of metal lath wired together, with $\frac{1}{4}$ " reinforcing rods sandwiched between or outside the layers (depending on the wall thickness you want) to hold the cage in the desired shape.

You can start with our table or create a project all your own—perhaps based on the design sketches on the opening page. Or you might want to put the system to work on a garden fountain or a small boat.

Almost anything goes. Whatever the project, when you sketch out your design, forget old concepts and limitations, such as the flat planes of lumber. Curves not only look better in ferro-cement, they're stronger than wide, flat surfaces. But keep them simple; avoid double curvatures. These are tough to form in metal lath. Circles, cylinders, cones, and scrolls, on the other hand, are a snap.

Once you get your design assembled in double-thick wire mesh, try to figure where the areas of greatest strain will occur. Set a light load on it and see where greatest bending comes. Then wire extra strips of mesh on at these points,

for a thickness of three or four layers.

The real basis of ferro-cement construction is the reinforcement. Concrete will follow anything you can do with the metal lath. Keep the 28"-by-96 $\frac{1}{2}$ " size of the lath sheets in mind as you design—though sheets may be lap-joined for larger surfaces, such as our table top.

We'd be misleading you if we failed to mention that metal lath isn't the most pleasant material to work with. Its sharp edges cut your hands, skin your knuckles, and snag your clothing. The only

[Continued on page 190]

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QUIETONE MF Ceiling Panels slip into suspended grid. Shown is popular Fissured pattern

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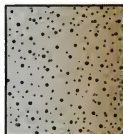
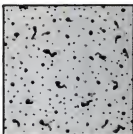
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Steel components for grid: Wall Angle, Main T, Cross T.



USG Ceiling Panels: Fissured (left) and Pin Perf patterns.

UNITED STATES GYPSUM

Ferro-Cement Furniture: Build It to Last Forever

[Continued from page 188]

sane way to work is wearing leather or heavy canvas gloves. But once the lath is shaped, the fun begins.

Metal lath isn't the only reinforcing mesh you can use in ferro-cement work. Nervi used both chicken wire and expanded metal. I rejected these because the first is so open you'd need many layers to lock in the grout—fine for thick boat hulls, but not for furniture. Expanded metal is expensive compared with metal lath and offers no special advantage. The most promising alternative to plaster lath is hardware cloth. I'd recommend $\frac{1}{4}$ " mesh. Whatever your choice, remember you'll need at least two layers; a single layer of mesh just won't hold the grout.

Mark your mesh with chalk or crayon and cut with snips; I used the aircraft type with rubber grips. Use easy-bending mechanic's wire to tie the layers and sections together. Cut off several dozen $1\frac{1}{2}$ " lengths, bend each into a U shape and insert it through the lath. Twist the protruding ends together with a pair of pliers, then snip off the ends and bend the twist down on itself. Don't leave any tie wires sticking out.

The grouting job. Anything goes when it comes to grouting your concrete mix into the layers of mesh. A wide, flexible plasterboard joint knife handles a lot of material, though it's no good on sharp curves. I found small trowels too slow. You'll end up doing much of the contour grouting with your bare hands. If the alkali in the cement roughens your skin too much, wear rubber gloves.

Grouting goes best if the lath is positioned with its openings facing down. You can dump mix at the bottom of vertical surfaces and trowel upward to fill every opening. Two groutings are required. The first fills the mesh and creates a structure. The second covers the mesh to protect it from corrosion—and provides an attractive surface. Let the first grout coat set up, then brush on a coat of neat cement paste—portland cement and water. Use enough water to produce a melted-ice-cream consistency. Before this dries, spread on a topping layer of sand mix to about $\frac{1}{8}$ " thick. If you've fumbled your hand-shaping of

the edges, you can finish them off with this topping layer.

For the initial grout, packaged sand mixes, such as Sakrete, work fine—or you can mix your own, using one part portland cement to three parts concrete sand. Either way, add just enough water to make the mix workable. Don't use a mortar mix for grouting—it's too weak.

To add color to your project, you have a choice of methods. The best is to build it of integrally colored concrete. Just use white cement and add the desired concrete pigment as you mix in the sand. Or use regular gray sand mix for the structure, let it set, and brush on the neat-cement bonding agent; then trowel on a topping layer of colored concrete.

You can also stain or paint your project. But if it's a bench, be sure to use a nonchalking exterior paint that's compatible with concrete.

Building the Planter Table. You'll need six sheets of plaster lath. The base is made from four sheets doubled, rolled into scrolls, and wired together. You can add a false bottom of doubled lath, wiring this to the inner walls to form a planter recess. This avoids having to fill the core full depth with soil. Depending on the plants you'll use, you may want to leave small drainage holes and fill the recess partly with pebbles before adding the soil.

The table top is formed of two sheets of lath, pieced out with scraps. No reinforcing rods are needed. The inner flange fits into the planter base to keep the top from shifting. When fully grouted, the top is $\frac{3}{8}$ " thick, and weighs 75 pounds. For winter storage, you just lift it from the planter base and roll it on its rim.

If filled with earth, the base may be left in place. But if you want the two sections to weather equally, empty the base and put it in storage.

The total cost for the lath, $\frac{1}{4}$ " rods, wire, packaged sand mix, and coloring pigment was about \$10. Just try to match that price in any other material!

If, in your experiments with ferro-cement, you come up with a better mesh than that blasted metal lath—would you let me know? I've still got my matching scroll chairs to build.

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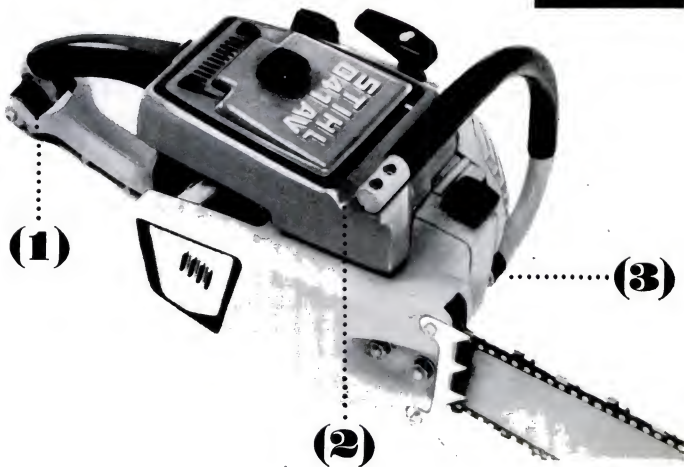
Vibration

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Belle Glade
Boca Raton
Cocoa
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4300 Ponce De Leon
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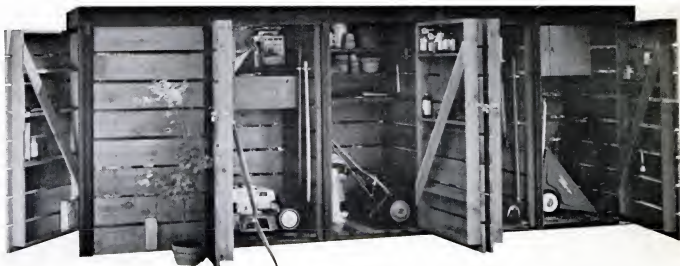
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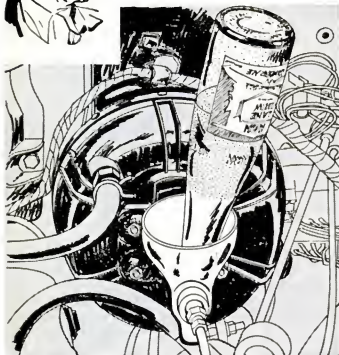
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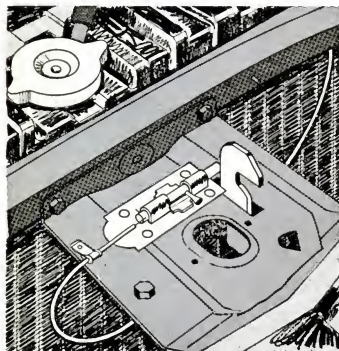
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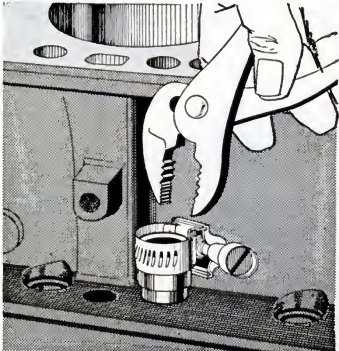
Brakes must be bled when refitting wheel cylinders after overhaul. To keep system from running dry, feed brake fluid to the master cylinder from a bottle. Leave the bleeder screw open. When fluid starts dripping through, no more bleeding is necessary.



Window-button rods that drop down inside a car door can be retrieved with this simple tool: a conical spiral of tightly coiled copper wire, brazed or soldered onto a 6" length of 3/32" rod. The tight coils easily engage the threads of the button rod for lifting it.



Make a foolproof dash-operated hood lock for a '68 Chevy (and other cars with a similar hood lock) with a door bolt and a standard 90" choke cable. Install the bolt so it prevents the latch from freeing the hood. Pull the cable to unlock the hood, push to lock.



Jammed valve lifters in six-cylinder engines can usually be removed with a worm-drive hose clamp. Tighten the clamp; then twist the lifter while pulling it out. This way, you avoid the nuisance of removing the oil pan to drive up the lifter from the bottom.

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The Basement with Movable Walls

[Continued from page 166]

I avoided the extra work of installing shelf standards by using Masonite's Living Wall—a random-grooved hardboard panel with slots in some of the grooves to take shelf brackets. My furring provided the necessary space, behind, for hooking in the brackets. Living Wall comes in the same wood tones as Royalcote; I chose Honeystone Cherry for everything but the feature wall, which has a white rough-sawn effect, for contrast. The wood-grain molding for this wall is actually plastic—a two-part unit with a nailing strip and snap-on clamshell, made by Gossen Corp., 2040 W. Bender, Milwaukee 53209.

The framing for the partition was a standard two-by-four assembly: first, a sole spiked to the floor with concrete nails; a top plate nailed across the joists; studs fitted between. I faced the entire framing before adding the bar and snack shelf. If I ever want to dispose of one or the other, the wall won't be spoiled.

The Brunswick pocket-billiard table—which had started all this—served as my utility bench. It had come knocked down in carton; squashed flat, the carton made a fine auxiliary work top.

Surefooting high heels. With the paneling in place, I turned to the floor. For durability and easy maintenance, I wanted vinyl-asbestos tile, but I was afraid it might not provide ideal footing around the billiard table—especially for female friends who might try contortion shots in high heels. So I tiled an 8-by-12-foot playing area in carpet tile—no problem, since both the vinyl and the carpet came in one-foot squares.

Now I was ready to shop around for accordion partitions. There are many kinds, of course, including inexpensive fabric types. But I was after glamour, to complement the wall paneling. The best folding door I found in prefinished wood is made by Woodfold-Marco, Box 346, Forest Grove, Ore. 97116. The mahogany plywood panels are five inches wide, joined with continuous metal hinges and a vinyl seal, and hang from nylon wheels or glides in a steel track. Folded, they occupy only one inch per lineal foot, and can be positioned anywhere on the track.

I chose the top of the line—Woodfold's 400 Series—for my main partition. The

The Basement with Movable Walls

joints are capped with wood astragals. The 100 series, without astragals, conceals the furnace area, and an economy door (with four-inch-wide fiberboard panels) separates shop and laundry areas.

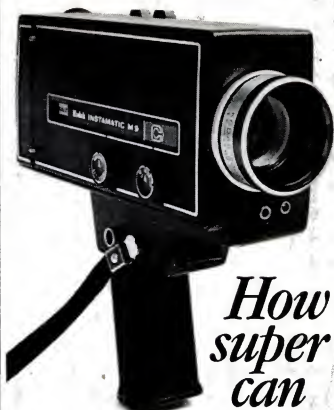
You order these partitions to the size of the finished opening. They're made to any width, and proper top and bottom clearance is allowed at the factory. If you want the track to bend, a curvable aluminum track is available at extra cost.

Where the track would be closed at both ends, I fastened one end with a loosely driven screw, swung the track to one side, and fed the door onto it, then pivoted the track into position to drive the remaining screws.

The light fixture over the billiard table is specially designed for such installations. The acetate domes have a grid diffuser to soften the light. Called the Cue Master Pool Light, it's available from Kentucky Billiards Mfg., 3624 Decoursey Ave., Covington, Ky. 41015.

An "intrusion alarm." Since this basement is isolated from the rest of our split-level home—more so, now that the acoustical ceiling cuts down on sound transmission through the floor—I felt some electronic communication was in order. In the color photo of the entry wall, on the lower shelf of the stairway partition, is a transistor intercom-radio system made by Talk-A-Phone, 5013 N. Kedzie, Chicago 60625. The flat box lying on top of this—deliberately inconspicuous—is an ingenious "intrusion alarm" that scans the party room with an invisible ultrasonic beam. Once it's activated (when the basement is shut up for the night) this watchdog will detect any motion in the room, turn on the lights, and trigger an alarm bell upstairs. We've an additional scanner at each outside door, upstairs, to alert us to intruders while we're in the basement. The system is available from L. E. Carson Co., 173 W. Madison St., Chicago 60602.

The final bit of electronics in that same photo is the 11-inch portable TV made by Broadmoor Industries, 530 Santa Rosa, Des Plaines, Ill. 60018. It's ideal for stowing on a shelf, and lets me break for the news and then go right back to my game. After all the work my passion for pool cost me, I'm not about to miss a shot. **PS**



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To the North Pole on a Snowmobile

[Continued from page 58]

knees, instead of seated, we chopped off the back half of the seats to make the kneeling position more comfortable.

In extreme Arctic cold, the standard plastic fuel lines are brittle. Walt replaced them with mylar lines, which are softer. He mounted speedometers, and degreased almost every part, outside of the engine, that would ordinarily be lubricated. The snowmobile tracks were studded with golf-shoe cleats to give more traction.

But most importantly, Walt designed an auxiliary tank that doubled our fuel capacity, and he installed a fuel filter with an element of 40-micron porosity that kept our fuel clean and avoided engine problems.

We did most of this work at our base camp on Ward Hunt Island, just off N. Ellsemere Island, at the edge of the sea ice over which we would travel to the Pole.

Our support group of four—John Moriarity, George Cavouris, Wes Cook, and Andy Horton—were at Tanquary Fjord, many miles to the south where the bulk of our fuel was. (Temporarily with them was Jerry Pitzl, who would join us later.) They were busy pumping fuel from large barrels into smaller ones that could be flown to us on the ice.

Takeoff time. Walt and the rest of us worked on the machines right up to the minute of our departure from base camp at 1:30 p.m. on March 7. It was minus 62 degrees when we left Ward Hunt Island. We were 474 miles south of the Pole. Actually we would have to travel many extra miles because we drove over the sea ice, which drifted constantly from west to east.

It was so cold that Walt had to light a piece of rag dipped in gas to warm the carburetors and get the machines started. We threw away the air cleaners so the torch could be held right under the carburetors.

Going was so rough the first day that we managed only 4½ hours of travel. The problem was ridges. The ice keeps jamming together, building up pressure ridges as high as 40 feet and 125 feet wide. It's worst just offshore.

We had to chop through many of these ridges, virtually cutting roads through

the ice, with axes and long ice chisels. Then we'd have to fill in the holes to level the ice for the snowmobiles to run through.

The team. Six of us started out: Jean Luc Bombardier, our scout; Walt Pederson, who brought up the rear so nobody would be left behind because of a broken machine; Dr. Arthur Aufderheide, our photographer and temporary navigator; Don Powellek, deputy leader and our electronics expert. Ernst Michael, a movie cameraman, and I were the others. Two of the party rode in snowmobile-towed sleds.

Settling in. We made camp at six p.m. This consisted of two tents pitched inside a square formed by our machines and sleds. We tied the tent ropes to the snowmobiles so they wouldn't be blown away.

Our first meal was prepared from the special rations developed for us by the Pillsbury Co.—cartons containing breakfast, lunch, and dinner. It took 45 minutes to prepare a meal, since we had to melt snow to make water to mix with the dehydrated food.

The food rations contained about 5,000 calories a day per man. We all took vitamin tablets. Three of the four men who went all the way to the Pole, including myself, lost about 10 pounds during the trip. Walt Pederson somehow gained 10 pounds.

Progress was slow. After three days, we ran out of gas and radioed our pilot, Weldy Phipps, to fly some out. He dropped three 10-gallon barrels, but one broke—the one with white gas we desperately needed for our stove and heaters. So we went without heaters in the minus-50-degree night, using what little white gas we had for cooking. Doc, Walt, and I slept in one sleeping bag to keep warm. That was the way it was for three days.

Then our plane got out to us again and made a beautiful drop—20 gallons of white gas, 30 gallons of snowmobile fuel, and even some steaks.

On our eighth day, one of the machines burned out an ignition coil. The disabled vehicle was towed onto a large pan of ice where we made camp for the night.

While setting up camp, one of the

Continued

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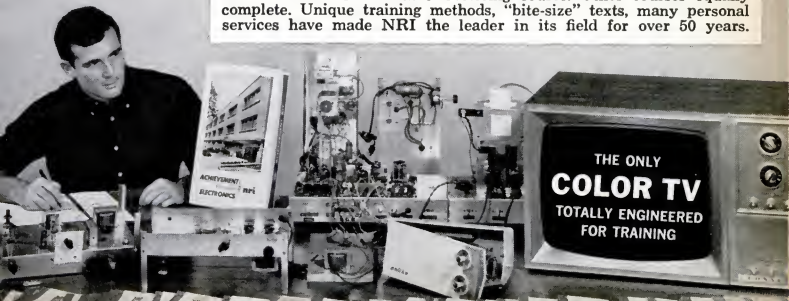
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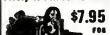
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To the North Pole on a Snowmobile

tents got torn. Art and I stitched it up. It was so cold that we could only do three stitches at a time. But it was a good thing we sewed up that rip.

Whiteout. A whiteout (an Arctic snow cloud condition that confuses visual perception) accompanied by a vicious storm immobilized us when we were only about 40 miles out from our base camp. We stayed in our sleeping bags for about 18 hours a day for seven days.

I could hear the ice crashing into the pan we were on. It sounds like an artillery barrage. You wonder if the ice you're on is going to break up from the pressure around it. Winds of more than 50 m.p.h. tore at the tents. Anxiety hit me. I was sure the tents would be torn away or they'd catch fire from the fuel we stored, and you just don't stand a chance in that weather without shelter.

We tried to forget our fears by reading paperback mysteries or listening to a Wollensak cassette recorder. We had only a few tapes with us and listened to the same music over and over.

Meanwhile the men at base camp were busy and worried. We were out of radio contact most of the time. Moriarity and Pitzl were at Ward Hunt Island. George Cavouris, Andy Horton, and Wes Cool still were at Tanquary Fjord getting our fuel dug out of the snow and ice it was buried under. We needed Pitzl, because he was our navigator—the guy who'd have to pinpoint the Pole for us.

Doc Aufderheide decided he could do more at base camp to help us make it. So he offered to take Jerry's place and give up his chance to reach the Pole. He would return as soon as the plane could bring Pitzl out.

Finally the storm ended. Weldy was able to fly again and he brought much needed gas and a coil to replace the one that had burned out. Doc went back with him, along with the cameraman.

On our way. Even though snow had packed in all around the engines, they turned over quickly and cleared themselves.

We started out again. It was grueling, rough on the knees, but we were making time. Jean Luc rode ahead all the time, looking for breaks in the ridges and ways to get over the leads. He would

Continued

To the North Pole on a Snowmobile

limb up to the top of a ridge, take out a cigarette and calmly survey the situation as he puffed. He would either find a way to ride around or pick a place where it would be easiest to hack through.

Everyone wanted to keep going to make up for the lost time. In the week following the storm, we made about 60 miles—still 374 miles from the Pole.

The weather continued brutal. One night was so cold, a bottle of Scotch froze only two feet from my head. It scared me to think of what that same cold might be doing to my head!

We continued to have support problems; Weldy was having a tough time landing whenever he flew out with supplies. The beacon receiver in the nose of his plane wasn't picking up our signal.

On April 2, Don Powellek went back with Weldy to fix the beacon receiver. It would be serious if our beacon couldn't be picked up when we got farther out. Don stayed at base camp the rest of the time to mother our lifeline, and he kept the vital beacon going for us. Weldy was flying with little reserve gas, and he couldn't afford to spend much time cir-

cling around over the ice in search of us.

Don's return to base cut our party to the final four who would make it to the end. We really started to move. By April 4, we hit the halfway point—86 degrees, 21 minutes north latitude, 71 degrees west longitude.

Dangerous crossings. We had to cross many thin, newly frozen leads, perhaps eight to 10 times a day. Once Jean Luc went through the ice of a lead and the water came within two inches of the top of his sled.

Often the ice would part as we raced over a lead. Only the momentum of our snowmobiles kept us going. If the engines had conked out, we'd have gone down.

The men at base camp and at Tanquary cheered us on. Every time we radioed that we had crossed a degree, they celebrated.

The machines held up fine. On very cold days, however, we'd lose drive belts—four in one day. They shattered like glass.

Although we were making good mileage, we had to make up for the drift of the

Continued



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To the North Pole on a Snowmobile
ice. If you stood still you could move far off course. One day, we lost eight miles because of the drift.

Jerry Pitzl was now making very precise navigational fixes. He used a Plath marine sextant. It had a bubble attachment, which creates an artificial horizon, necessary because the horizon on the ice is so irregular.

About four miles from the pole, we stopped. Jerry wanted to stay in one spot so he could shoot hourly fixes on the sun for a whole day and pinpoint our path for the final few miles.

We began to worry again because the drift had stopped. Sitting on this ice, we were sure we'd get to the Pole; but now that we had to move again, we felt no certainty that we'd actually be parking our vehicles at the North Pole. What if the Pole were located in the middle of a lead? And what if we suddenly got hit with a storm now that we were so close? Suppose we never got there after so much work toward that goal?

But the weather held up for us.

The big moment. When we reached a spot Jerry felt was within walking distance of the Pole, we set up our final camp. Soon an Air Force plane would be coming over to verify our position. And Weldy would be landing to carry us and our equipment back as soon as we got the word.

The Air Force plane, a WC 135, came over about an hour later. I talked to the pilot over our beacon as his navigators checked and rechecked our position. Then from directly overhead, the pilot, Maj. Albert Cardinal, radioed the good news: We were at the North Pole!

It had taken us 43 days to travel the 474 miles between Ward Hunt Island, our departure point, and the Pole. We actually covered 830 miles.

As we were flying back, I thought about the things that had made our success possible. The element that stood out was team effort—the selfless work of all the men, both at the base camp and out on the ice.

Could we do it again? Maybe. The Arctic is a fierce mistress. If you succeed, you can only say that you've been lucky—not that you conquered her. ■

Which Lightplane Design Is Best?

[Continued from page 77]

the top portions (which govern damping in roll, and aileron control) are unstalled and still flying satisfactorily while the center portion of the wing is stalled, and the airplane as a whole is flying at maximum lift and minimum speed.

Accident protection may be provided in case of a hard landing, by the low wing under the passengers.

To permit small airplane size, the low wing is advantageous, one maker claims for given inside dimensions, it allows fuselage of less cross-sectional area.

So, which to choose? At this point, you may still be up in the air. So let's look at some statistics:

Today's buyer has more than 70 single-engine models to choose from. About 5 have fixed gear, and all but 12 of these are high-wing aircraft. Some 22 have retractable gear, and all but two of them are low-wing models.

An accompanying table breaks down the number of high-wing and low-wing single-engine aircraft, for personal and business use, produced by the entire industry in the four-year period of 1964-1967. (It includes trainers, but excludes agricultural planes.)

You'll note that the percentage of high-wingers increased each year through 1966; it dropped back last year, but remained a commanding 55 percent. During this whole period, Cessna's high-wing line dominated the Big Five's single-engine market.

One major company queried about 8,300 single-engine-aircraft owners as to reasons for their choice. In order of importance, they cited cost of operation, performance, safety, ease of flying, and size. As a basis for choice, high or low wing did not even reach 10th place. I may be a talking point, this company thinks, that comes up only after many other factors have been weighed.

Is the high- or low-wing choice, after all, simply a matter of personal taste? In the words of John Parkinson, chief of NASA's aerodynamic branch:

"There is more than one good way to do anything—as there is to engineer an airplane with good handling qualities either high or low wing." ■

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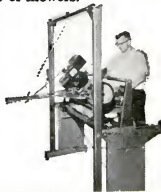
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Family Learning Center You Design

(Continued from page 156)

stock is unavailable, you can form the $1\frac{1}{2}$ " width by ripping 1"-thick strips from $\frac{3}{4}$ " boards, then laminating pairs face-to-face for each pole. You'll also need hardwood strips for shelf endpieces and desk-top edging, plus the $\frac{3}{4}$ " triangular gussets for the box butt joints and kneehole bookshelf unit.

- Sand a narrow chamfer on the edges of butt-joined parts prior to assembly; it hides minor mismatching.

- Prepare all panels for finish prior to assembly. If you glue with care, this reduces sanding time. Although the forward edges of most shelves can simply be taped, the shelves or box tops that will serve as desks should be faced with laminate and edged with hardwood strips. Attach the strips with glue and countersunk finishing nails or screws; cap the heads with matching wood putty or plugs cut from scrap.

- Standardize on screw sizes (No. 10 $1\frac{1}{4}$ " flathead are best, here) and invest in a good screw pilot drill. For safe, sound construction, all joints must be glued and screwed. To secure the box bottoms in their rabbets, drive screws both through the sides, into the end grain, and angled up through the bottom.

- Drill mounting holes in poles and components prior to finishing, using the template shown. Trial assembly (of the complete center) is a good idea, so you can make minor adjustments before taking it apart for finishing.

Assembling the center. At least the first two sections should be assembled back-side-down on the floor, then tipped upright. Additional sections can be added, holding the units in place with clamps as the next set of poles is attached. Use $\frac{1}{4}$ " bright cadmium-plated bolts for assembly, and turn on acorn nuts where ends are exposed.

Buying the accessories. If you can't find them locally, you can order the carved walnut pulls, bookend brackets, sliding-door track, adjustable shelf supports, and drop-leaf brackets from Minnesota Woodworkers Supply Co., 925 Winnetka Ave. N., Minneapolis 55427. Concealed pivot hinges, T nuts, and $\frac{1}{2}$ "-clearance drawer slides are available at most hardware stores.

New One-Hand Chain Saw

[Continued from page 127]

suburban neighborhood, a reasonably quiet chain saw will keep the neighbors happy.

● **Vibration.** Since most is absorbed by the rubber inserts on the handle, the Mac 6 is easy on the hands. You can hold it steady, making cut after cut, and your hands never get that red, spotty look that excessive vibration causes. This is important to the man who uses a saw over long periods.

Ease of maintenance and service are other features I liked about the saw. By simply removing six screws you have access to the fuel-tank system, manual-starter unit, carburetor, and ignition system. Chain-assembly adjustment in the field is quick and easy because the bar/chain assembly is attached to the saw with just one nut.

The design differences, compared with the bigger Mac 10 line, are a chrome-plated cylinder bore rather than a cast-iron liner, and a needle-point main bearing in the flywheel side of the crankcase. Both of these changes were made to reduce weight but do not affect performance.

Designed to run on regular automotive gasoline (mixed 40:1 with McCulloch's oil), a tankful gives about 30 minutes of running time under normal usage.

Almost no smoke. On all counts I rate the Mac 6 an outstanding new tool. Standing back—out of the path of flying chips and sawdust—I couldn't help noticing that the saw produced almost no engine smoke. And, though there is a manual oiler button on the saw, my white shirt came through the tests without a smudge.

Priced at \$170, the saw is a particularly good buy for suburban and vacation-home owners, sportsmen, campers, or anyone with serious, but lightweight, cutting problems. Though not designed for heavy-duty cutting, the little saw is rugged enough to be used on an occasional basis to fell fairly hefty trees. Well built, it should give years of satisfactory service under normal home use.

Available at McCulloch dealers nationally, the Mac 6 comes ready-to-cut with a factory-installed 12-inch cutting bar and chain. A 16-inch bar and chain is available as a dealer-installed option at slightly higher cost.

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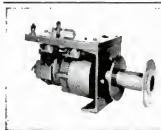
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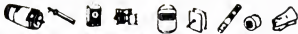
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Is There a Steam Car in Your Future?

[Continued from page 67]

stitute a fluid that won't freeze. Some current research is aimed at finding a substitute working fluid. Gill insists that the chemical companies can come up with one.

Some other problems, with the defenders' answers, are:

- It takes too long to generate enough steam to move. (Zero time is almost here.)

- You have to use an auxiliary exhaust valve to rid the cylinders of water created when the steam condenses on a cold day at the first crankshaft rotation. (Another working fluid can be found.)

- For any given horsepower, an ECE is heavier, all around, than an ICE. (It could be even lighter.)

- Water and oil for top cylinder lubrication emulsify, causing wear and necessitating replaceable liners and a gravity oil separator. (Another fluid.)

- ECEs are bulky, filling the space under the hood and the trunk as well. (There are ECEs today that fit neatly under the hood, and there were 40 years ago, too.)

- The manual steam cutoff is bothersome. (A cutoff can control this automatically, with pressure-temperature sensors in the exhaust stream.)

- Steam ECEs can explode. (Hah!)

Today's monotube generators carry a couple of cupfuls of water at any time. Try getting an explosion out of that!)

Something startling may happen soon in the ECE field. Research, as yet insufficiently financed, is under way.

VW steamer. Among the experimenters is Richard J. Smith, Santa Ana, Calif., who has pulled 250 hp. from a 40-hp. Mercury outboard motor converted to steam and installed in a Volkswagen. Controlled Steam Dynamics of Mesa, Ariz., and Provo, Utah, has developed a compact engine with pistons paralleling the power shaft. The Elliptocline engine [PS, Feb. '66] is still very much in being.

Under a Ford contract, the Thermo-Electron Corp., Waltham, Mass., is experimenting with ECEs using a working fluid other than water. Ford is quick to say that this has no present application to cars. GM has experimented with a free-piston hybrid vapor-electric engine.

Is There a Steam Car in Your Future?

Kinetics, Inc., Sarasota, Fla., says it has a 350-hp. ECE using freon 11 as a working fluid. Freon freezes at minus 185 F., but even hermetically sealed in, boils at 390. Knowledgeable engineers say that's too low for an efficient heat engine.

Another brother team, A. M. and E. Pritchard of Caulfield, Australia, are working on an ECE car that, they say, will get 22 to 23 miles to the U. S. gallon. Energy Systems, Inc., Cambridge, Mass., headed by Richard Morse, who helped prepare the Department of Commerce report, is researching ECEs.

There is even talk of entering a steam car in the Indianapolis 500-mile race in 1969.

The men at Thermal Kinetics, researching "vapor" engines (which means

steam and its substitutes), certainly are no dreamers. Neither is Gill.

Needed: money. "I have little doubt," says he, "that the public will be able to buy external-combustion automobiles within three years—provided sufficient development funds are made available." Gill not only is exploring fluids other than water but looks favorably on a rotary engine like the Wankel for EC because it is compact, simple, and even more vibration-free than Gill's test model.

Oddly enough, GM has offered to foot the bill for 16 Williams cars at \$10,000 and up per copy for experimental use by the California Highway Patrol.

Then, there's always the federal government to reckon with. The politics of smog could lead to a crash program on ECEs tomorrow. □



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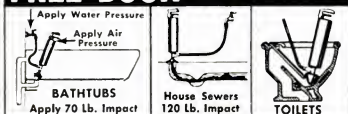
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New Catalytic Heater Uses Propane

[Continued from page 132]

ishing amount of heat, it is almost fool-proof from a safety standpoint. I turned it up to full capacity and then tried to ignite a facial tissue by placing it on the head. It didn't even turn brown when laid on the grill.

Then I forced the tissue right onto the burning head and held it down with a pencil. With this additional pressure, I could get the tissue to turn brown, but was unable to get it to ignite.

BernzOmatic engineers say that even if you pour such highly combustible liquids as gasoline or naphtha directly on the burning head, it will not ignite these substances. Instead, they told me, these liquids will actually act as a fire extinguisher—putting out the heater by depriving it of an adequate oxygen supply.

The explanation for this phenomenon: The platinum catalyst in the head permits oxidation to take place at between 700 to 900 degrees, instead of at the 1,200-degree temperature that normally is required to burn propane. Because the oxidation occurs at the lower temperature, no flame is produced and the temperature always remains below the point where other materials will ignite.

Ordinary oxidation dissipates much of the warmth that is produced by heating the air around it. The catalytic burning process avoids this. Radiant energy produced by this type of heater travels through the air *without heating it up*. The heat is not dissipated until it is absorbed by some person or object.

But it is extremely important to remember, always, that oxidation is taking place when you're operating the heater. This means that it must be used in an area where there is adequate ventilation—or you'll be burning up all the oxygen in your camper or your tent and inviting suffocation.

Turning off the heat is as easy as starting it. You don't have to use a snuffer as you do with other types. Just close the valve and the heater, deprived of fuel, extinguishes itself.

The little warmer-upper is small and light—only 14 inches high, about 10 1/2 pounds with two full fuel cylinders inside. And any cold-weather hunter or camper can have one for about \$40. **ES**

Stairway to the Moon

(Continued from page 92)

step, Mission F is a circumlunar flight. The spacecraft cluster will circle the moon for days in lunar orbit; and the manned Lunar Module will separate from the CSM and descend almost to a lunar landing; before returning to a rendezvous.

Mission F thus would be a complete lunar-landing flight, minus the touchdown. Possibly it may be skipped, if results of earlier missions warrant going directly to a lunar landing; but by present expectations it will probably be flown, with Apollo 10.

In its plan, the manned LM will separate from the CSM 25 hours after arrival in lunar orbit, about 70 miles above the moon. A short burn of the descent-stage engine will put the LM in an elliptical orbit ranging from that altitude down to only 9.2 miles above the lunar surface—three times as near as our picture-taking Lunar Orbiters' closest approach.

If the LM crew were going to land, an eight-minute retardation burn would begin at this low point. In Mission F, instead, other burns will raise the LM's flight path and bring its ascent stage back to a rendezvous with the CSM—the descent stage being jettisoned midway.

A mock rescue. Three days later, with all three men safely back in the Command Module and the LM ascent stage cast adrift, the CSM will simulate a "rescue" mission to the unmanned and passive ascent stage. This will show the CSM able to come to the help of a disabled ascent stage in lunar orbit—using its own VHF ranging-tracking system, with no navigational assistance from the earth.

Mission F would thus provide practical experience in operating navigation and communication systems over lunar distances; determining and correcting a lunar orbit; identifying landing sites, beginning a manned lunar landing; making a manned rendezvous in lunar orbit; and demonstrating rescue capability.

Those are the steps of the stairway to the moon that will lead up to Mission G—the actual lunar landing. Thus the crew for the final assault will not have to master all its complexities from scratch, in one daring try—but can draw upon the combined experiences of the crews of the earlier partial missions.

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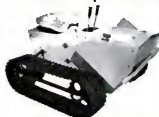
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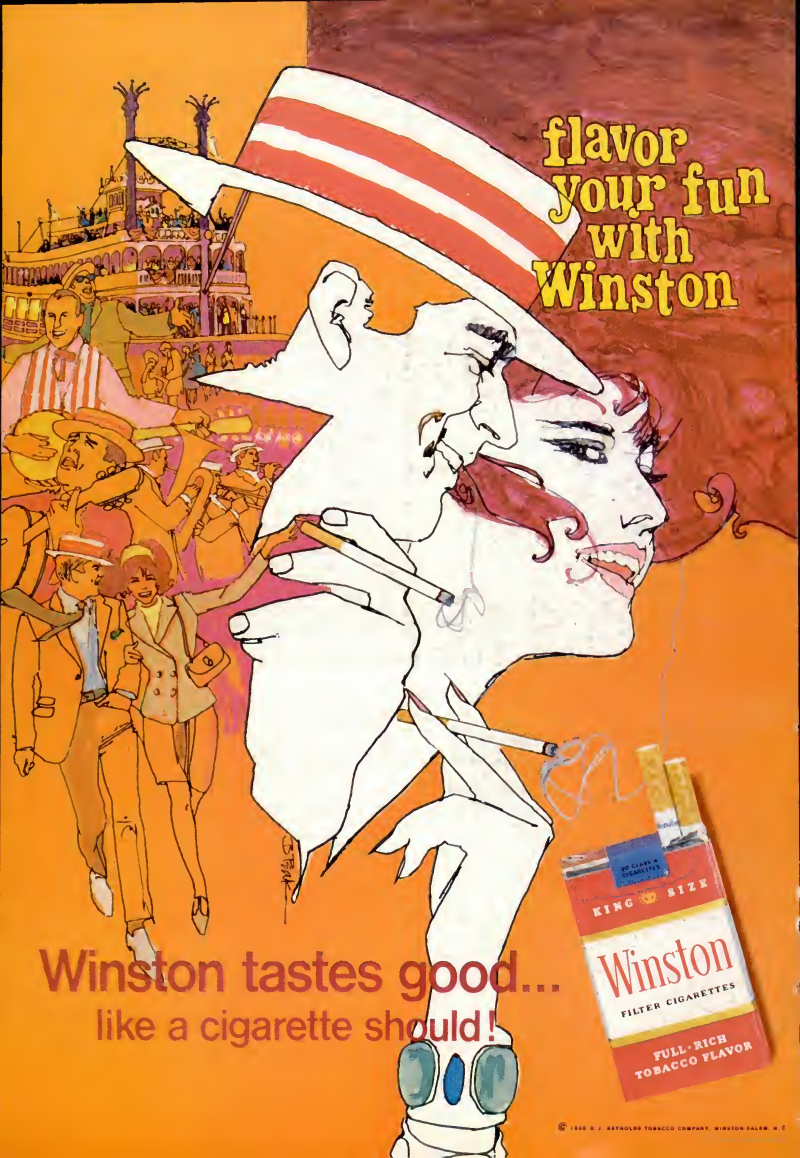
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